World Week

SCIENCE IN ACTION

EVERYBODY'S INTERESTED when industrial science brings forth a new product like Du Pont "Orlon" acrylic fiber. (It resists the weakening effects of sunlight, mildew and corrosive acids better than other organic fibers—makes possible sturdier curtains, clothing and industrial filter fabrics.) But few people are aware of how such developments are brought about in today's industry. Here is how it is done:

THE IDEA may originate in one man's head. Then teamwork is needed to make it a reality. Usually chemists develop a small quantity of the product in the laboratory so it can be tested to see whether it is something that people will buy.

IF IT shows promise, the next step is to make larger quantities for more thorough testing. So Du Pont engineers set up a miniature manufacturing plant. When the process calls for unusual pieces of equipment, they often invent their own.

NOW WE'RE ready to design a full-size plant for all-out production. Scale models like this are carefully studied by engineers experienced in manufacturing problems, and by instrument designers, electrical and power supply specialists, etc.

BUILDING THE plant is also a job for Du Pont men, for the Company does its own construction work. The services of civil, chemical, mechanical, electrical and other graduate engineers are required. They may also set up production lines.

EVEN WHEN the plant is built and the product marketed, Du Pont scientists continue to look for new ways to use it, and methods for making it better and cheaper.

Industrial research never ends. Right now hundreds of different projects are under way in the Du Pont laboratories . . . in scores of different fields, ranging from electrochemicals to rayon, from finishes to film. One of these days, with the right college training, *you* may join a Du Pont research group and participate in discoveries greater than any of the past!

Questions students ask Du Pont

How many kinds of engineering are there?

—G. V. C., Illinois

Modern industry uses the services of men and women specializing in more than 100 different engineering fields—in everything from ceramics and instrument design to forestry and building materials.

Where do Du Pont scientists make their headquarters?

—A. L. MacC., New Jersey

Eight of the Company's research groups are located in Wilmington, Del. Other laboratories are located in 11 states, from Connecticut to Texas. Scientists also work in sales offices or plants in 25 states.

Send your question about career opportunities in science to *Science in Action*, 2521 Nemours Building, Wilmington, Delaware.

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)

World Week

A National Magazine of Social Studies and International Affairs. Published Weekly During the School Year.

EXECUTIVE AND EDITORIAL STAFF

Maurice R. Robinson, President and Publisher
Kenneth M. Gould, Editor-in-Chief
John W. Studebaker, Vice-President and Chairman of the Editorial Board
Jack K. Lippert, Executive Editor

Sturges F. Cary, Associate Editor, World Week; Assistant Editors: Robert Stearns, Sarel Eimerl, Irving DeW. Talmadge (Foreign Affairs), Nancy Scandrett (Features), Arthur Knight (Movies), Herman Masin (Sports), William Favel (Vocational); Mary Jane Dunton (Art Director), Sarah McC. Gorman (Production Editor), William D. Boutwell (Editor, Scholastic Teacher), Lavinia Dobler (Librarian), Lucy Evankow (Library Research), David J. Lane (Teacher Edition).

G. Herbert McCracken, Vice-President and Treasurer • Don Layman, Vice-President and Director of Sales Promotion • C. Elwood Drake, Associate Director of Field Service • Agnes Laurino, Business Manager.

EDITORIAL ADVISORY BOARD, 1952-1953

Miss Clara V. Braymer, Consultant for Social Studies, Trenton, New Jersey.
Dr. Stanley E. Dimond, Professor of Education, University of Michigan, Ann Arbor, Mich.
Miss Carlie F. Dunster, Shelby High School, Shelby, Montana.
Mr. Jack W. Fletcher, Tarpon Springs High School, Tarpon Springs, Florida.
Miss Mary S. Greene, Brooklyn High School for Homemaking, Brooklyn, New York.
Dr. Sarah L. Miller, Simon Gratz High School, Philadelphia, Pennsylvania.
Mr. Oscar A. Neidich, Thomas Jefferson High School, Brooklyn, New York.
Miss Mary A. Selken, Capitol Hill Senior High School, Oklahoma City, Oklahoma.

WORLD WEEK, published weekly during the school year September through May inclusive except during school holidays and at mid-term. Entered as second-class matter at Post Office at Dayton, Ohio, under Act of March 3, 1879. Contents copyright, 1953, by Scholastic Corporation, and may not be reproduced without written permission. Marca Registrada. Member, Audit Bureau of Circulations. SUBSCRIPTION PRICES: 55 cents each a semester, $1.10 a school year. Single subscription, Teacher Edition, $2.00 a school year. Single copy, 10 cents, except special issues so designated, which are 20c each. Available on microfilm through University Microfilms, Inc., Ann Arbor, Mich.

Office of publication, McCall St., Dayton 1, Ohio.

General and Editorial Offices, WORLD WEEK, 351 Fourth Ave., New York 10, N. Y.

CONTENTS THIS ISSUE

Quick Look at the News 5
World News in Review 6
INDUSTRIAL RESEARCH:
What's It All About? 9
Your Automobile: Where It Comes From 12
Careers in Science and Technology 14
Stick to Your Math 17
Metal of the Moon (radio play) 20
From Formula to Fiber (nylon) 24
People Who Work in Glass Houses 26
Science Makes Your Future 28
FOREIGN AFFAIRS: Latin American Problems 34
Newsmaker 36
Say What You Please! 36
Ask Gay Head 40
How Would You Solve It? 44
Following the Films 46

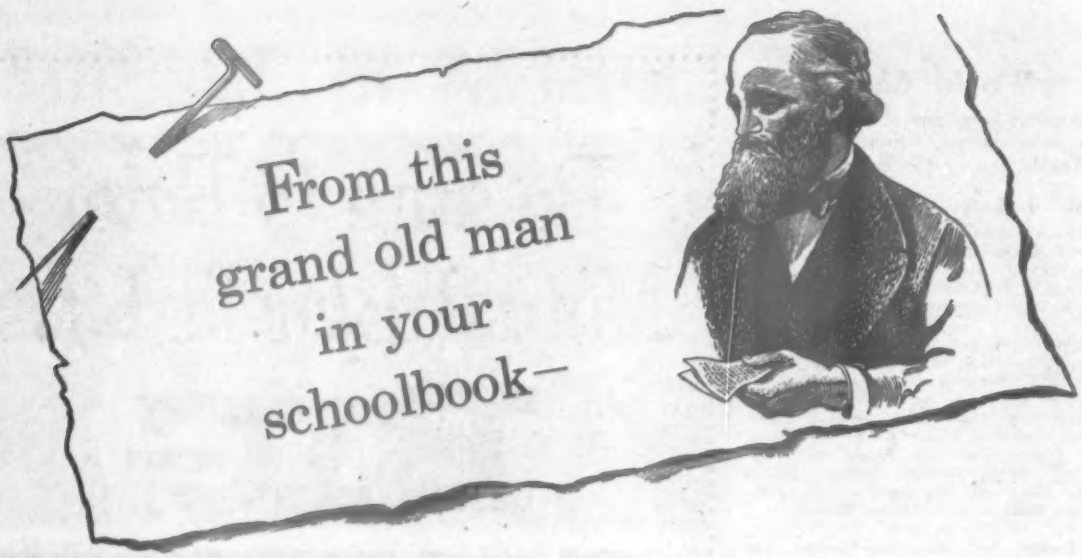
Be sure to Enter Mutual Benefit Life's BIG CONTEST Now!

There's still time to get your entry in, and you may win the $1,000 Government Bond or one of 27 other valuable prizes. But your entry *must* be postmarked before midnight, Tuesday, March 31.

All you do is write us—in your own words—"How I Would Use $1,000 in My Personal Plans for the Future." For example, if you figure it will be five years before you complete school and start earning your regular income, you might want to use one-fifth of your $1,000 to buy insurance now, and set the balance aside to pay premiums until you start working. That way your insurance would be paying you dividends—you'd be getting interest from your bank—you'd have money always available—and you'd have protection at very low rates!

That's only *one* way to use $1,000. Now sit down and write us how *you* would use it! Mail your entry to Mutual Benefit Life Contest, care of Scholastic Magazines, 351 Fourth Avenue, New York 10, New York.

THE
MUTUAL BENEFIT LIFE
INSURANCE COMPANY
Educational Division
300 Broadway, Newark, New Jersey



came this brand-new idea to make better car bearings

EVER wonder what the point is in learning the theories of such old-timers as the early physicists, Michael Faraday, Joseph Henry and James Clark Maxwell?

Well, our General Motors engineers could give you a very quick and serious answer. Particularly, right now, about James Maxwell in the case of engine bearings.

* * *

A BEARING, as you probably know, is a metal "cushion" which protects a moving part of an engine, such as the crankshaft, from excess wear. In recent years, as engines have become more and more powerful, the need to build engine bearings able to take over tougher punishment without splitting or cracking has increased by leaps and bounds.

Nearly a hundred years ago James Clark Maxwell set forth what is known as the Maxwell Theory of what happens to the energy absorbed by a piece of metal under terrific strain. And in their long and intensive research to improve bearings—marked by many major advances in bearing design and materials—GM engineers have recently found new clues to reducing bearing fatigue in this old schoolbook law.

By building the three dimensional plastic model (shown below) illustrating the application of Maxwell's Theory, they have come to conclusions which will help them design and build even longer-wearing bearings for cars, trucks, planes and tanks.

So don't ever take the old-timers in your books lightly. They may very well be helping unlock a problem right now for American industry. Just as they may very well help unlock a future for you as a much-needed scientist or engineer with such an industrial leader as General Motors.

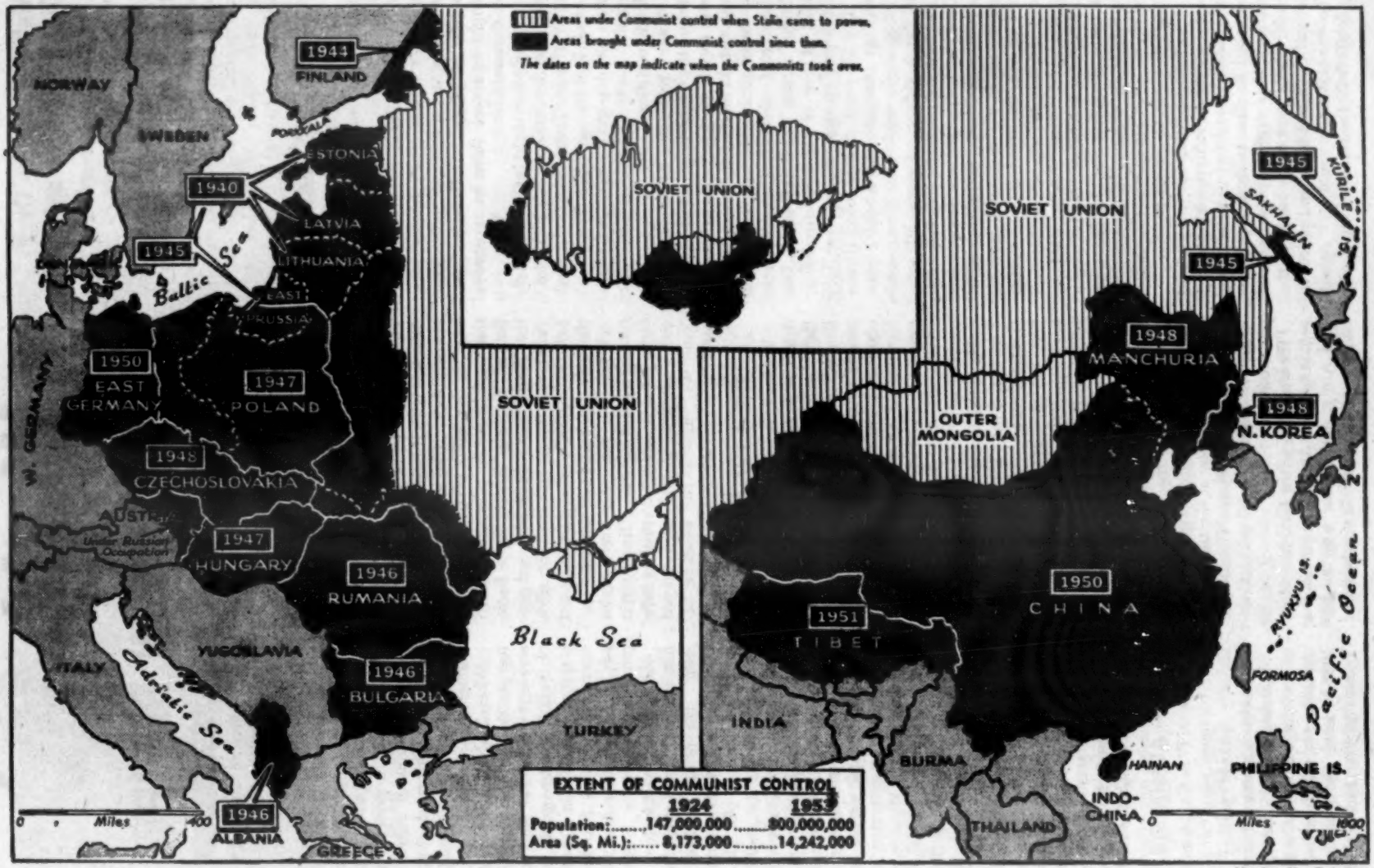
GENERAL MOTORS

"More and Better Things for More People"

Your Key to Greater Value – The Key to a General Motors Car

CHEVROLET • PONTIAC • OLDSMOBILE • BUICK • CADILLAC
BODY BY FISHER • FRIGIDAIRE • GMC TRUCK & COACH
GM DIESEL • UNITED MOTORS SERVICE • AC SPARK PLUGS

Hear HENRY J. TAYLOR, on the air every Monday evening, over the ABC Network, coast to coast.



Map from New York Times

Quick Look at Russia as Stalin left it: During his 29 years as dictator, Russia was transformed from a backward farming nation into the second most powerful industrial nation in the world—second only to the United States. Output of iron and steel increased six times; oil, four times; coal, nearly 10 times; electricity, more than 20 times. Turn page for story on the "change of masters" in Russia.

World News IN REVIEW

THE IMPORTANT TRENDS IN A WEEK OF HISTORY

Malenkov Takes Over Stalin's "Red Empire"

Russia and its "Red empire" are under new management.

Joseph Vissarionovich Stalin, who ruled over 800,000,000 subjects, is dead *(see last week's news pages)*. His place has been taken by Georgi Maximilianovich Malenkov. The name is pronounced gee-OR-gee (with "hard" g's, as in "Magee") Max-e-meel-YAN-o-veech mal-lyen-KOV.

THE OLD LEADER

Last week Stalin was laid to rest in the Mausoleum on Moscow's Red Square. He lies beside his predecessor, Vladimir Lenin, the first dictator of Soviet Russia. Their bodies, preserved by secret methods, remain on public display—and Russians are taught to revere them as supermen of communism.

During the night of March 1-2, Soviet leaders announced, Stalin suffered a brain hemorrhage. He died March 5, at the age of 73. Ten physicians and top government and Communist party officials signed the death certificate.

Stalin's real name is Dzhugashvili. Before the Communists came to power in Russia, they were illegal revolutionaries, hunted by the police. Many of them used nicknames instead of their real names. The nickname "Stalin" means "steel" in Russian. The alias of one of his co-conspirators, "Molotov," means "the hammer."

For 29 years, Stalin ruled Russia with an iron fist. The son of a poor Georgian shoemaker, he became one of the world's most powerful men. Like Ivan the Terrible, like Peter the Great, he was a ruthless despot—and a builder of Russia. Stalin was a minor figure in the Bolshevik Revolution of 1917, in which a small group of Communists seized the Russian government. After Lenin died in 1924, Stalin and two others became a three-man committee of leaders. One by one Stalin eliminated his political rivals. By 1928 Stalin was the undisputed dictator of Soviet Russia.

During his "reign," the government took control of farming. Millions of peasants who resisted were killed or banished to slave labor camps. Russia was also rapidly industrialized under Stalin, and today ranks as the second mightiest industrial power in the world.

In 1936-38, thousands of top Soviet officials were—at Stalin's order—accused of "treason" and executed. Tens of thousands of others were jailed. According to reports made to the U. N., over 10,000,000 persons are still in Soviet concentration camps.

In 1939 Stalin signed a pact with Hitler, dictator of Nazi Germany. This freed Hitler of worries over possible war with Russia and he attacked his neighbors. Two and a half years later, in the midst of World War II, the Nazis broke the pact and invaded Russia. To help Russia fight back, the United States in three years provided the Soviet government with $11,000,000,000 worth of military aid through the lend-lease program.

When the war was over, Stalin turned against his allies. He brought huge areas under his control as Russian "satellite states," and waged "cold war" against the Western nations.

THE NEW LEADER

Within 24 hours after Stalin's death, a new leader took over. Neither the 200,000,000 people in Soviet Russia, nor the rest of the 800,000,000 people in the Soviet "empire," were consulted. The choice was made by a handful of Communist party politicians.

Malenkov, Stalin's successor as premier of the Soviet Union, is 51, moon-faced (*see photo*), short (5 ft. 7 in.), and fat (250 lbs.). Malenkov is described as merciless and humorless, but also as competent. He has been characterized as having a "card-index mind." He never forgets figures or faces.

What's Malenkov's background? Unlike Lenin and Stalin, he was not a Communist in the illegal, "underground" days of the party in Russia. He was only a boy at the time of the Bolshevik Revolution. His whole adult life has been lived under Communist rule.

He was born in the Ural Mountain region. At 17, Malenkov joined the Red Army, and a year later he became a member of the Communist party. Then he was sent to Moscow to study at the Higher Technical School for administrators.

In 1925 Malenkov became one of Stalin's personal secretaries.

Malenkov's work was largely with the Communist party organization. Thus he was in position to control the distribution of various government posts. This made it possible for him to build up a strong personal following in the party.

When Stalin became premier—the top position in the Soviet Union government—Malenkov took over most of Stalin's work as party boss. Now, stepping into Stalin's shoes as premier, Malenkov is also keeping his job as top man in the Communist party machinery.

Under the Soviet system, the Communist party really runs the government. No other political party is permitted. The Communist party picks government officials, from the top level down to the smallest village.

Malenkov is said to be a tough taskmaster. He has banished many an inefficient Soviet executive to Siberia.

He has never been outside the Soviet-dominated realm, and he has never given an interview to a correspondent from a Western nation.

In his public speeches, Malenkov has spoken out against the Western powers, and has bitterly denounced the United States.

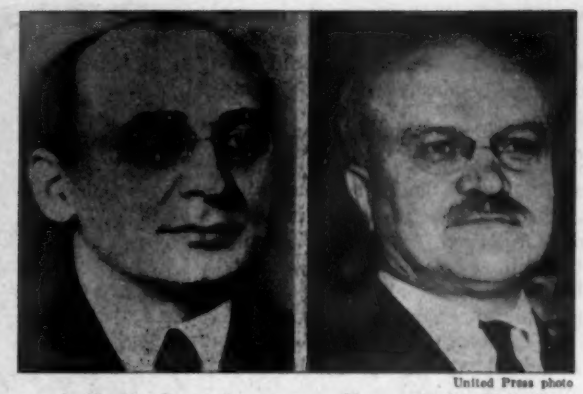
At Stalin's funeral, he pledged his government to work for peace and higher living standards. (Russian leaders often call for "peace"—by which they seem to mean victory over the Western democracies, and submission to Communist orders.)

"NEW ADMINISTRATION"

Lavrenti P. Beria, 54, a deputy premier, for many years minister of state security (secret police), now becomes also minister of internal affairs.

Vyacheslav M. Molotov, 63, a deputy premier, resumes the post of foreign minister, which he had held from 1939 to 1949. He replaces Andrei Y. Vishinsky, who is named chief Soviet

Berfote



United Press photo

RUSSIA CHANGES BOSSES: Georgi Malenkov, Russia's new premier, is at extreme left. Photo, taken at Moscow's May Day parade in 1949, shows Malenkov in the place of honor at the right of Stalin, Russia's leader from 1924 until his death this month. The No. 2 man in power, ranking next after Malenkov, is believed to be Lavrenti P. Beria (third from left), head of the secret police. No. 3 man is probably Vyacheslav Molotov (extreme right), who replaces Andrei Vishinsky as foreign minister.

U. N. delegate. Vishinsky, who hurried home to Russia after Stalin's death, was temporarily replaced at the current U. N. Assembly session in New York by Andrei Gromyko, Russian ambassador to Britain. He was formerly Russia's U. N. chief delegate.

Marshal Nikolai A. Bulganin, 57, a deputy premier, who was a sort of "political overlord" of the armed forces, is appointed minister of war.

Beria, Molotov, Bulganin, and Malenkov are the new "Big Four" of Soviet Russia.

Another change is the designation of Marshal Klementi Voroshilov, 72, as the chairman of the Presidium of the Supreme Soviet (parliament). You might translate that as "president of the Soviet Union." It is a "decorative" post with no real power.

WHAT'S AHEAD?

Will the "Big Four" stick together, or will they begin squabbling among themselves? After Lenin's death, the Communist party was torn by the strife between the "Big Two" of that time—Trotsky and Stalin. The struggle lasted for several years. In the end, Stalin came out on top. But Russia was on the verge of civil war.

So far, the new "Big Four" presents a united front to the outside world. How long this "unity" will last is anyone's guess.

THE SATELLITES

If a struggle for power develops in the Kremlin, the Soviet empire may begin to crumble at its edges—in the satellite states. Any sign of weakness in Moscow may tempt some of the satellites to desert the Soviet camp, as Marshal Tito, Red dictator of Yugoslavia, did in 1948.

How about the Chinese Communist chieftain, Mao Tse-tung? He has regarded himself as second only to Stalin. In his first statement after Stalin's death, he pledged loyalty to Russia. But as a leader of the world Communist movement, will he be willing to play "second fiddle" to the "young upstart" Malenkov?

U. S. POLICY

As far the "cold war" is concerned, most observers do not anticipate any great change in the Soviet program.

Western government officials, including our own, have seemingly adopted a "wait and see" policy. The free world is not relaxing its defenses.

Secretary of State John Foster Dulles told a press conference that our Government saw no reason for any particular change in U. S. policy as a result of Stalin's death.

"As Stalin dies," said Mr. Dulles, "General Eisenhower, the man who liberated Western Europe, has become President of our great republic, with a prestige unmatched in history. A new era begins, one in which the guiding spirit is liberty, not enslavement, and when human relations will be those of fraternity, not one-man domination."

"America Votes" Award

The American Heritage Foundation has acclaimed Scholastic Magazines for our contribution to better citizenship through our 1952 pre-election special issue, AMERICA VOTES.

Out of more than 15,000 entries, AMERICA VOTES received the Foundation's award for "the most effective special issue of a magazine in support of the [Foundation's] National Non-Partisan Register and Vote Campaign." Chairman of the awards committee is Charles E. Wilson, former president of General Electric Company and former defense mobilizer.

AMERICA VOTES was Part 2 of the October 1, 1952, issue of the various Scholastic magazines.

The Foundation's awards to counties, cities, and states with outstanding "get out the vote" records were listed in last week's news pages of *Senior Scholastic*.

Hiding from the Atom

Atomic bombs have been set off in the past to help science or to help the army—but this week's atom test is intended to help *you and me*.

An atomic weapon mounted on a tower in the Nevada desert was scheduled to be exploded March 17. Officials are loosing the terrible blast against many of the articles you use every day. From these tests they hope to learn how to advise you to protect yourself in an atomic warfare danger zone.

The Civil Defense Administration built, and completely furnished, two two-story wooden houses. They were much like millions of other American homes—except that each had its own private bomb shelter in the basement. One of the houses was built a half-mile from the center of the explosion. The other stood three miles away. The Government wanted to

see what would happen to the houses and their contents when the blast went off. For example, would furnishings be dashed into the bomb shelter?

A hundred automobiles—some used cars, some brand-new—were parked at different distances from the center of the blast. The cars faced in different directions. Some had full gas tanks, some had half-full tanks, some had no gas. Windows were rolled up in some, down in others.

In each car there was a dummy—a shopwindow mannequin. Some dummies were dressed in winter clothes, some in summer clothes. Some were on the floor of cars; some were sitting at the wheel; some were lying in car seats.

Civil defense officials from every state were invited to the tests. Maryland Civil Defense officials picked Mrs. William F. Melville, Sr., 51, as one of their delegates. She was chosen as typical of average citizens who volunteer for civil defense work in their home areas.

Squeeze on Red China

Great Britain plans to help the United States put a new squeeze on Communist China.

Britain agreed to cut down on shipment to Red China of "strategic materials"—that is, materials useful for war. These include not only guns and ammunition, but metals, fuels, and other goods for war industries.

The agreement was announced in Washington, D. C., after conferences between British and U. S. officials.

The British agreed to forbid ships owned by Britons or flying the British flag from hauling war-useful goods to China. Furthermore, ships bound for Red China with strategic materials won't be able to get fuel at any port in the British Commonwealth of Nations.

What's Behind It: Non-Communist countries shipped more than $300,000,000 worth of material into Communist Chinese ports last year. More than 700 ships registered in free world nations called last year at Hong Kong—a British colony which trades largely with Red China—and at Red Chinese ports.

In addition, the Chinese got more than 250 shiploads of goods from the Soviet Union and Red satellite countries. U. S. Navy officials estimate that 40 per cent of China's imports for war come in by sea. The rest come overland—by railroad, caravan and highway—mostly from Russia.

Science Talent Institute photo

SCIENCE TALENT Search winner for 1953 is E. Alan Phillips, 15, of Lincoln, Mass., a student at Weston High School at Weston, Mass. He received the $2,800 Westinghouse Grand Science Scholarship for studies (involving complicated mathematics) on whether the earth would stay together if it were made of water. Phillips is shown with an electrical generator which he made.

Not all the goods carried by free world vessels into China were on the list of "strategic materials"—although the goods may be used in war industries. Western European nations shipped in chemicals; Ceylon and Indonesia sent rubber; India sent jute; Pakistan and Egypt sent cotton.

Many of the countries whose ships trade in Chinese ports are fighting with United Nations forces against the Chinese Reds in the Korean war. The United States wants to stop this "trading with the enemy."

In 1951 the United Nations General Assembly urged halting of strategic materials shipments to Red China. As a result, 65 nations agreed to cut down their shipments. The United States and Canada have banned all exports to Red China.

A majority of the ships which have carried goods to China have been British or British Commonwealth vessels.

Will the new agreement weaken Red China's war machine? Will France, Italy, Greece, the Scandinavian countries, and other free world nations join Britain in clamping down on the Chinese trade? Can trade with China be stopped without use of warships to blockade Chinese ports?

THE NEWS IN BRIEF

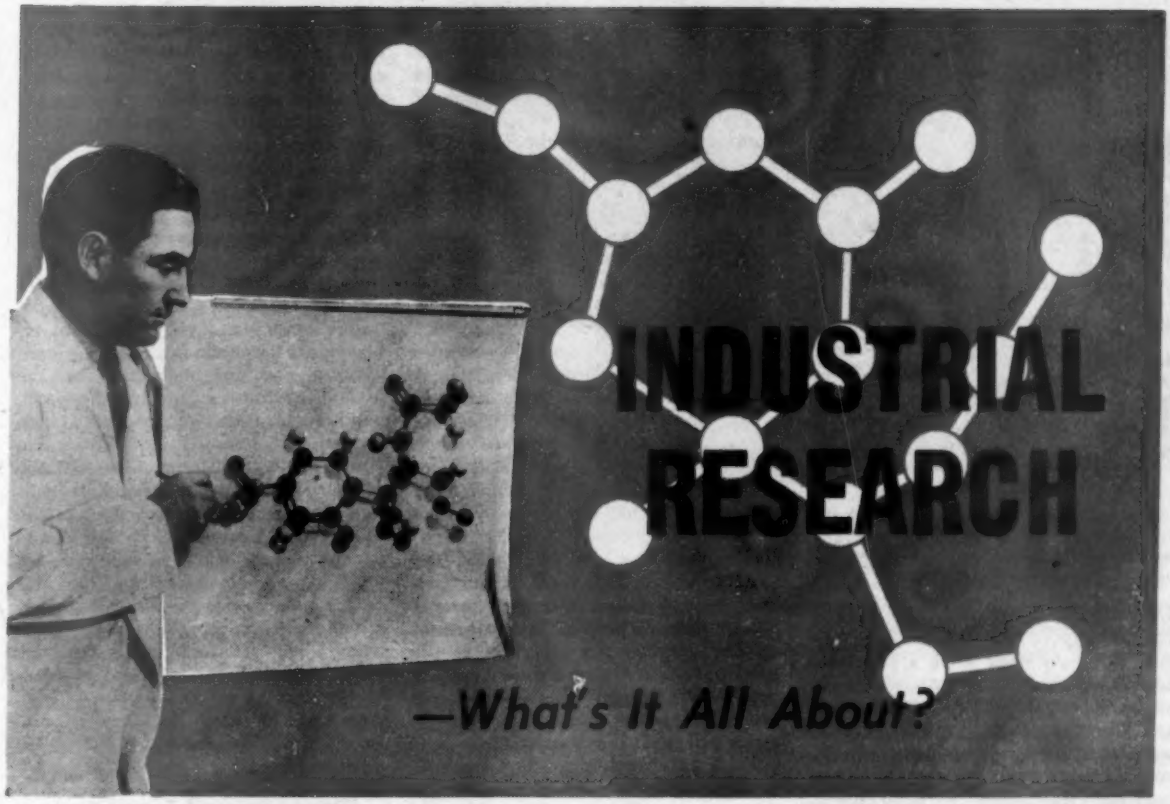
PLANE "INCIDENT": The U. S. Government strongly protested to Czechoslovakia over the shooting down of a U. S. Air Force plane in the U. S. zone of Germany March 10. The attacking planes were two Russian-made MIG jet fighters which came from Czechoslovakia, 15 miles away, the Air Force said. The U. S. pilot bailed out safely.

ON THE SHELF: Congress has decided not to act—at least, not right now—on one of President Eisenhower's proposals. He asked Congress to pass a resolution denouncing Russia for breaking postwar agreements. Some Republicans wanted to go farther than the President, and add a hint that they disapprove of the Yalta agreement made by the late President Roosevelt *(see March 4 news pages)*. Democrats balked. So the whole proposal was "pigeonholed."

VINCENT RETIRES: John Carter Vincent is leaving the diplomatic service. Senate investigators in 1950 and 1952 accused him of disloyalty *(see Jan. 7 news pages)*. This month Secretary of State John Foster Dulles overruled the Civil Service Loyalty Review Board, which had found "reasonable doubt" of Vincent's loyalty. But Dulles added that Vincent's performance of duty had fallen short of standards required "at this critical time." The Secretary accepted Vincent's resignation. He will receive an annual pension of $8,100. Vincent had recently been serving as U. S. Minister to Morocco and diplomatic agent at Tangier, North Africa.

Quick Quiz ON THE NEWS

What do you know about Russia? Its population is about _____ million, and altogether there are about _____ million people under Russian domination. Russia ranks in _____ place among the world's industrial nations. The Communists got control of Russia in _____. The first dictator, Vladimir _____ _____, was succeeded by Joseph _____, and he in turn by Georgi _____.



INDUSTRIAL RESEARCH

—What's It All About?

(Above left) At Parke, Davis & Co.'s Holland (Mich.) plant, a chemist shows structure of the "wonder drug," chloromycetin.

HOW well do you think your radio or TV set would operate without those rows of vacuum tubes? Yet they are among the most delicate and expensive parts of your machine. Without them, you could not hear the weak electric vibrations carried over the airwaves.

Ever since the dawn of electronics, physicists have sought for a cheaper and more reliable way to amplify an electric current. About five years ago two scientists working at the Bell Telephone Laboratories, W. H. Brattain and John Bardeen, found the answer. Instead of delicate glass, filaments, and vacuums, they found a solid that would amplify better than the best tube. It is a little sliver of crystal called "germanium"—one of a group of strange metals known as semi-conductors. Brattain and Bardeen found that a current entering one face of a germanium crystal emerged from the opposite face with an amazing increase of power. This object, no larger than a pea, connected to three little wires, they called a "transistor."

For many uses the tiny transistor seemed destined to replace the far more bulky and less durable vacuum tube. But years of additional research at the Bell Laboratories were necessary.

Their success is demonstrated by the transistors now in use—rugged and compact devices which amplify sound 100,000 times, and do not require one *millionth* of the power of the smallest vacuum tube. Even the earliest versions of the transistor are estimated to have a lifetime of about ten years, in contrast to the shorter life of vacuum tubes.

Engineers foresee the day when vacuum tubes and their socket connections will be largely eliminated from electronic devices; when electronics will be extended into fields where the vacuum tube is not practicable; when entire circuits, including the transistors, will be embedded in protective plastic packages. Already transistors are helping to reduce the size and improve the performance of electronic devices ranging from computers to portable radios. A new word—"transistorizing" is heard in the electronics world, as engineers eagerly study ways to use the transistor in improving a thousand products.

Applied vs. Basic Research

The work which resulted in the invention and commercial development of the transistor is the kind of work that goes on every day in thousands of industrial laboratories for *applied research*. This kind of research is aimed at solving problems of practical importance, and it is undertaken because it is expected to lead to practical rewards. Applied research may include fundamental studies which will contribute to the success of the research project. In the case of the transistor, for example, a great deal of fundamental research on the structure of the germanium crystal was necessary.

But when a scientist chooses his problem and his methods of solving it only because he is moved by the spirit of scientific inquiry, we do not call his work "applied research." Such research, conducted mainly to enlarge man's boundaries of knowledge, is known as *basic research*. Basic research is carried on largely in universities, and to some extent in Government laboratories, but only rarely in industry.

Most of the research performed in the United States is applied research, and much of it is performed in industry's own laboratories. Industrial firms also sponsor a great many specific research projects in universities and research foundations. Many large companies award research fellowships which enable promising young scientists in universities to do basic research on problems of their own choosing.

Industrial Research Is Born

Forty years ago it was hard to find an industrial research laboratory in the whole United States. Today there are

The electron microscope, important and costly instrument, was developed at the RCA laboratories by Dr. V. K. Zworykin, well-known inventor, and research team.

3,300 such laboratories, employing 165,000 people. All this is a far cry from the early days when a few well-established chemical and electrical companies such as E. I. du Pont de Nemours and General Electric first persuaded competent university scientists to devote some of their time to industrial problems. At that time, these companies were mainly interested in testing devices for better control of production processes. But as faith in industrial research increased, its role was gradually extended to improving the products of industry and production methods.

In many instances, the research scientist became a businessman, emerging from the laboratory to organize a new industry based on his own discoveries. Hall, who developed the first practical method of extracting aluminum from bauxite; Baekeland and Hyatt, who developed the earliest commercial plastics, bakelite and celluloid; Acheson, the discoverer of carborundum, an abrasive harder than steel—all these were researchers turned businessmen.

Their success stimulated other segments of American industry to establish research laboratories. Soon many companies were finding that research was good business. It created better products, which led to higher profits, thus enabling them to invest in still more extensive research. It is estimated that for every dollar now spent on research, three dollars in profits are being obtained as a result of past research. The process is circular and continuous.

A typical example of how industrial research has changed fundamental processes is that of U. S. Steel and the manufacture of tin plate. Up to 1937, all the tin plate produced in the world was made by the costly and laborious "hot dip" tinning process. In that year U. S. Steel scientists set up a pilot line to study the continuous production of tin plate by electrolysis, which deposits atoms of liquid tin on the underlying sheet of steel. Since then dozens of patents have been taken out representing improvements in the electro-deposition process. As a result, today over half our tin plate output is produced by the electrolytic process.

Free Enterprise Encourages Research

The freedom of American enterprise also encouraged industrial research. A company which did not seek endlessly to improve its products and lower prices by means of better production processes soon found itself at a competitive disadvantage. Businessmen with pioneering instincts saw in science a revolutionary method of meeting human needs. These men realized that the basic research performed in universities, although it is a necessary foundation for technological advance, does not by itself develop the products people need and want. Unless industry applied the knowledge gained through basic research, science would have only a minor effect on our way of life.

Du Pont offers an excellent example of the major role research plays in industry today. The company maintains 40 laboratories throughout the nation, employing 1,800 researchers, and an additional 3,200 other employees to assist them. Before World War I, Du Pont spent $300,000 a year on research. Today it spends $38,000,000. The expansion of research at Du Pont was paralleled in other chemical firms, and by companies in scores of other industries. A flood of new and better products has emerged from these laboratories in the last twenty years.

Nor is industrial research limited to large firms like Du Pont, General Electric, and Standard Oil. Small firms also engage in active research. If a company is too small to establish its own laboratory, it can hire the laboratory facilities and the services of highly competent scientists and engineers from independent research institutes or foundations. The first such institute, the Mellon Institute for Industrial Research, handsomely endowed by the Mellon family, was founded in 1913 at the University of Pittsburgh. The Battelle Memorial Institute, the Franklin Institute, the Armour Research Foundation, the National Research Corporation, and other research institutes followed, enjoying remarkable success. In 1950, nine of the major research institutes, operating on a non-profit basis, employed over 1,500 scientists and engineers, plus another 1,000 technical and administrative workers. Their bill to American industry "for services rendered" runs to about $40,000,000 a year.

How a "Research Team" Works

The research scientist or engineer of today is no longer the "lone wolf" inventor of the past. Individual initiative and creative ability are as essential as ever in research, but something new has been added—teamwork. The re-

The Chrysler Corporation uses radioactive metal parts from the Oak Ridge (Tenn.) U. S. Atomic plant, to test engine wear in their cars. Here technicians are handling a "hot point" and a Geiger counter under careful safeguards.

search worker functions as a member of a team assigned to solve problems. He may specialize in chemistry, physics, metallurgy, aerodynamics, thermodynamics, chemical or mechanical engineering, or any of a dozen other fields. But whatever his field, he merges his knowledge and experience with those of other members of the research team. Each team is headed by a project supervisor, or group leader, who periodically reports to the research director.

In World War II, for every front-line soldier on combat duty, it required 17 civilian workers behind the lines to keep him supplied. The research teamworker is the "front-line soldier" of industry. For every such scientist there must be from five to fifteen technical and non-technical workers who support his efforts. A chemist, for example, will have the aid of a laboratory assistant, literature researcher, librarian, patent chemist, glass blower, instrument maker, instrument mechanic, electrician, machinist, safety inspector, draftsman, and other trained personnel whose services he may require.

But modern industrial research demands even more than trained men and women. It also requires complex, and often fabulously expensive, tools. Industry spends literally millions of dollars on such research instruments as the electron microscope, which can magnify from 80,000 to 100,000 times; small-scale computers and large-scale "electronic brains" which save many thousands of man-hours formerly spent in calculation; mass spectrometers, to identify the different molecules found in gases and other substances that can be vaporized; ultracentrifuges, which subject test specimens to a force about 260,000 times that of gravity; the helium cryostat, which will produce temperatures close to absolute zero, or —460°F.; wind tunnels to study the behaviour of aircraft at supersonic speed —the list is almost endless. Small companies cannot afford costly machines of this type. Only the larger industrial and university laboratories can do so.

General Electric's weather scientist, Vincent Schaefer, produces a miniature snowstorm in a home freezer, under the watchful eye of Dr. Irving Langmuir, famous physical chemist (upper left), at GE's Schenectady research laboratories.

Women technicians play an important part in chemical and biological research. At the Mound Atomic Laboratory, Miamisburg, Ohio, run by Monsanto Chemical Co., researchers check weight of white rats which have had radioactive doses.

The Fruits of Research

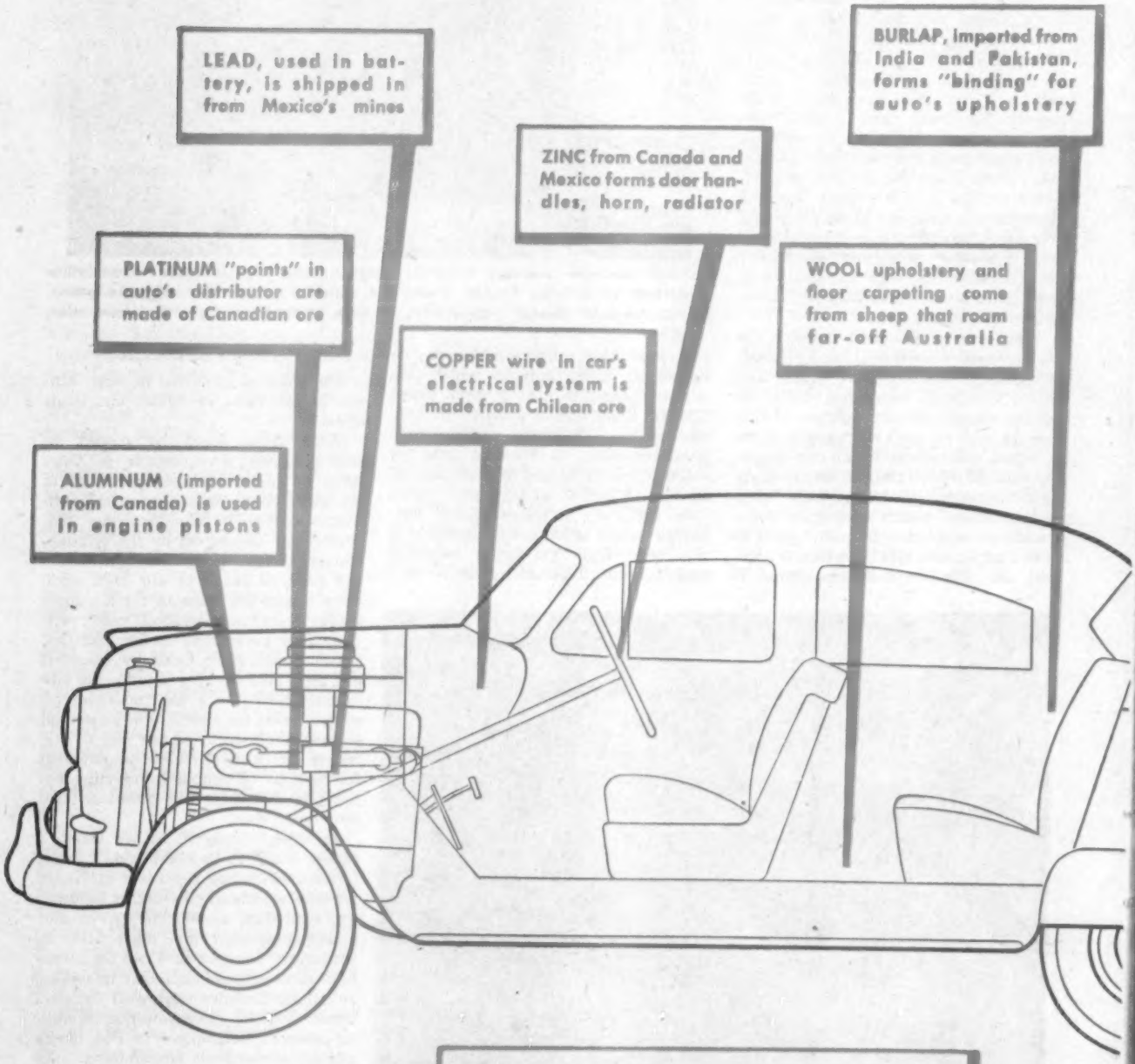
The value of industrial research cannot be estimated in dollars and cents alone.

What price could be placed on such life-saving inventions as the X-ray tube, on radioactive isotopes used in the treatment of cancer, or on the antibiotics and other "wonder drugs" pioneered and developed by the pharmaceutical industry, and brought within the financial reach of all? How shall we estimate the value of the advances made in radar, television, radio, aircraft and automotive design, textiles, plastics, and other fields by scientists and engineers working in industrial laboratories? Not only has industrial research raised our standard of living and immeasurably enriched our way of life, but it has also provided employment for millions of people by creating entire new industries and countless business enterprises.

Industrial research, as we know it today, is still in its childhood. It looks forward, with the eagerness of youth, for new worlds to conquer in electronics, synthetics, atomic energy, jet and rocket propulsion, and other fields as yet largely unexplored. Does the future hold three-dimensional color television, automatic factories controlled by electronic devices, atom-powered aircraft, jet-powered helicopters in the family garage, atmospheric conditioning, antibiotics that will conquer all the virus diseases? The answer will come in large part from the research laboratories of industry. Thousands of men and women are working this very day to make all these wonders come true.

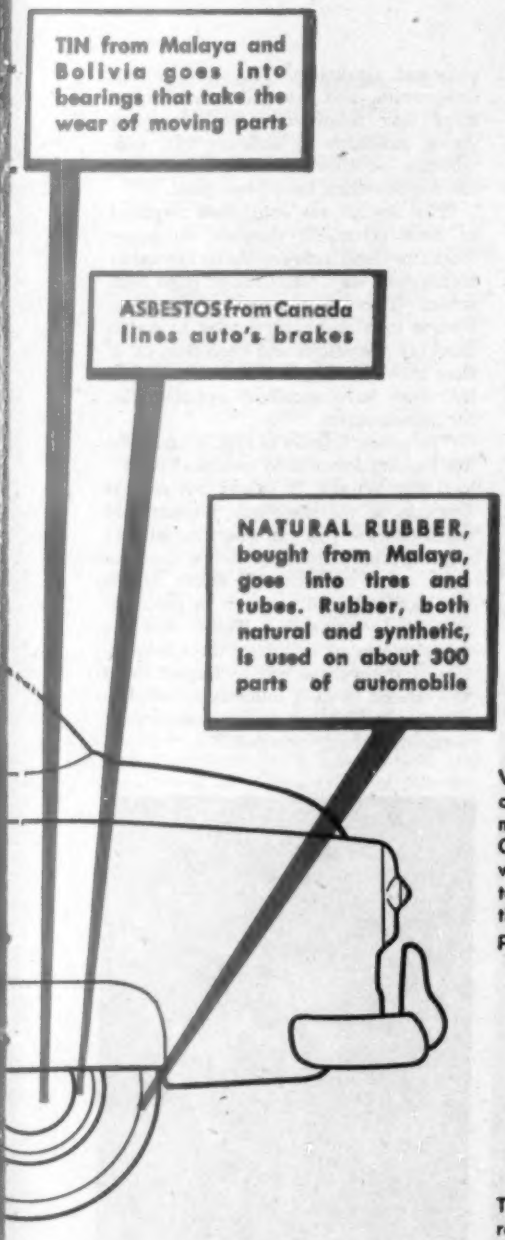
Your Automobile—Where It

About 300 products from 56 countries go into the American automobile.


LEAD, used in battery, is shipped in from Mexico's mines
BURLAP, imported from India and Pakistan, forms "binding" for auto's upholstery
ZINC from Canada and Mexico forms door handles, horn, radiator
PLATINUM "points" in auto's distributor are made of Canadian ore
WOOL upholstery and floor carpeting come from sheep that roam far-off Australia
COPPER wire in car's electrical system is made from Chilean ore
ALUMINUM (imported from Canada) is used in engine pistons

STEEL is the major "ingredient" of your automobile. A car uses some 70 different varieties. To make them, the U. S. buys CHROME from South Africa, MANGANESE from India, NICKEL and IRON ORE from Canada

Comes From


TIN from Malaya and Bolivia goes into bearings that take the wear of moving parts
ASBESTOS from Canada lines auto's brakes
NATURAL RUBBER, bought from Malaya, goes into tires and tubes. Rubber, both natural and synthetic, is used on about 300 parts of automobile

Cutaway diagram of 1953 model Chevrolet, and photos on this page, appear by courtesy of the General Motors Corporation.

"WHY?"—science's eternal question—is asked often in the experimental labs of U. S. auto manufacturers. Here, company researchers carry on tests and studies in a continual effort to improve the American automobile. (Photo shows General Motors lab.)

NEXT YEAR'S MODEL is always up for discussion among auto-makers. Salesmen, engineers, production men, cost experts—all help work out the new design. Artists produce sketches and sculptures (in clay and wood) of designs as they're being considered.

WHEN NEW DESIGN is decided on, auto manufacturers install new machine tools needed to produce it. Orders go out to independent firms who supply parts for auto-makers to assemble. (Photo shows production line at one of the 1,000 parts plants that supply General Motors.)

THEN THE ASSEMBLY line begins rolling. Bare car frames enter on the moving platform. As they move along, workers add parts. (Here, for example, they lower auto body onto chassis.) Finished cars emerge at line's other end. The U. S. made 5,500,000 cars and trucks in 1952.

Dr. Robert E. Wilson

Your Career in Science

"THE Battle of Britain, which prevented the conquest of England by the German Air Force in 1940, was won in the laboratories of America. It was 100-octane gasoline, developed by our research workers and engineers in the ten years before the war—and shipped overseas in enormous quantities—that made it possible for the gallant British pilots, with their few hundred Spitfires, to stave off the hordes of Nazi planes. The Germans had no such gasoline. That margin of technical superiority for us and our Allies changed the course of history and saved Western civilization."

This was only one of the many fascinating sidelights on industrial research in the petroleum industry told us by Dr. Robert E. Wilson, of Chicago. Dr. Wilson is Chairman of the Board of the Standard Oil Company of Indiana. Because of his special interests, he also serves as chairman of the research committee of the National Association of Manufacturers.

Dr. Wilson knows whereof he speaks. He is one of the few top executives in industry who reached his present position strictly through the research field. He used to be a professor of chemical engineering at the Massachusetts Institute of Technology. Then he transferred to Standard as assistant director of research in its great Whiting refinery. In the thirty years since then he rose by steady achievement to the top position in our second largest oil company.

"Bob is going to be a good research man. He's always sure there's a better way to do everything." That's what the head of the Chemistry Department at Wooster College, Ohio, once told the young man's mother. And in the course of garnering a half dozen academic degrees, publishing scores of technical papers, taking out more than 90 patents, winning the Perkin Medal and dozens of other honors, Dr. Wilson has never stopped looking for "a better way to do things."

Standard of Indiana (along with various other companies), beginning about forty years ago, developed the "cracking" process, which is the most important advance in modern petroleum chemistry.

Petroleum consists of hundreds of *hydrocarbons* (molecules made up of hydrogen atoms in varying combinations). But as it is found in nature, petroleum doesn't contain the best hydrocarbons for certain uses nor in the proportions that are most needed.

"Cracking" Petroleum

By the methods in use in the early days of the oil industry, only 15 per cent of crude oil could be turned into gasoline. Most of it became kerosene for lamps and stoves, and much of it went to waste. But Dr. Burton of Standard Oil foresaw that the infant automobile industry would boom so tremendously that the demand for gasoline would soon exceed the available supply. By new and ever-improving processes of intense heat, better equipment, and eventually by compounds called "catalysts," they cracked crude petroleum to more than double the yield of gasoline and eliminate the "knocking" in engines.

Dr. Burton, and later Dr. Wilson and his associates, not only produced more and better gasoline, but from the by-products they made toluene (an important element of modern explosives), butylene, the principal raw material of synthetic rubber, detergents (cleansers), asphalts and road materials, 500 types of lubricating oils, and the bases of many useful plastics.

And all this time the better methods they introduced through research kept down costs. The average price of gasoline today is only 30 per cent higher than in 1926. Without cracking, gas would be a luxury product today, costing at least a dollar a gallon.

"An industrial laboratory," said Dr. Wilson, "has the job of deciding what its company should be doing five or ten years ahead. It studies the trends in invention and production processes, and tries to foresee what new methods or steps are needed. Then it sets to work to find the answers.

"At Standard of Indiana, we couldn't stay in business without top-notch technical men. Every refinery and most of the departments are headed by a chemist or engineer. We take the best technical graduates from the leading universities, and we maintain scholarships and fellowships for promising young scientists at colleges and universities we select. Starting salaries are the highest they have ever been.

"Nor are all our employees required to have advanced degrees. In every laboratory and refinery there are many technicians who came direct from high school. They are needed to do many routine tests and control jobs, to watch machine operations and keep records. If they show intelligence and responsibility, they have excellent opportunities for advancement.

"To young fellows in high school who are looking forward to technical work," said Dr. Wilson, "I would advise that you take all the chemistry, physics, and math courses you can *now*. Be sure of your aptitudes for these fields. Keep an open mind on research. Don't decide too soon between research in pure science and engineering. Some men are more interested in theory than in practice, and they are just as important as the others. In fact, industry is only beginning to wake up to the necessity for supporting basic research."

Aluminum Co. of America

This apprentice is measuring the focal distance before taking an X-ray picture of an aluminum alloy casting.

and Technology

A Survey of Research and Training Policies in Some of America's Leading Industrial Corporations

Get Science Foundation Now

At **Ansco**, which manufactures photographic equipment, research and development laboratories play a prominent part in the planning, production, and sales activities of the company.

"Progress and growth," we were told by Dr. F. W. H. Mueller, Ansco's director of research and development, "are definitely dependent on the influx of young men, new ideas, and fresh viewpoints to replace those advanced to higher levels in the expanding industry."

Dr. Mueller went on to give some advice to ambitious students in high school. "By all means," he said, "choose those courses which will broaden your background in the sciences and mathematics; but by no means neglect the arts: English, composition, history, languages, etc. For what does it profit a man to have a thought or idea if he cannot express it in a manner that others may understand?"

Similar advice to high school students was given by J. S. Leermakers, assistant director of Research Laboratories at **Eastman Kodak Company.** "In our experience," Dr. Leermakers told us, "the most valuable type of preparation for a career in industry research is one which gives the student the most extensive training in fundamental science. Another quite important asset for a scientist in industrial research is the ability to express himself clearly and concisely, both in writing and speaking.

"When in high school the student should take chemistry, physics, and biology. In college, emphasis should be on the basic courses in science. Since most industrial research laboratories find it necessary to train young scientists in their particular fields, it is better for these young men and women to have a broad background rather than specialized knowledge."

Don't Neglect the Humanities

However, the student interested primarily in research ought not to neglect the humanities. "We would also suggest," we were told by R. G. Pearson, of the **Shell Oil Company,** "that in high school and college the student take as many credits as he can in the humanities—history, literature, languages, philosophy, art, etc.—courses enabling him to understand the attitudes and forces that have shaped the world in which he lives and in which he will put his scientific training to use."

At the **B. F. Goodrich Company** research ranks in importance with production and sales. The first research laboratory in the American rubber industry was established by the B. F. Goodrich Company in 1895.

"Scientific research," Dr. Howard E. Fritz, vice-president in charge of research of Goodrich, informed us, "has been directly responsible for the development of many of the raw materials and finished articles manufactured by the company from rubber, plastics, or other chemicals."

Training for the higher technical jobs at the B. F. Goodrich Research Center should include a full college curriculum specializing in chemistry, physics or chemical engineering. "Other useful qualifications," Dr. Fritz pointed out, "are a reading knowledge of French and German and an ability to express oneself clearly in written and oral English. Desirable qualities of character are imagination, flexibility, and patience."

How to Select a Specialty

How should a high school student interested in a research career decide what branch of science he ought to specialize in?

"General reading on scientific accomplishments," we were told by **Dr. R. P. Dinsmore, vice-president of the Goodyear Tire & Rubber Company,** "and active development of technical hobbies are the best possible stimulants to the proper selection and the further pursuit of a scientific career."

Dr. Dinsmore added a caution, however. "No one should select a scientific career," he said, "because he thinks it is an easy way of making money. It is true that well-qualified scientists and technologists are in great demand, and probably will be more so in the future. However, one should not choose this field unless he can combine both a genuine interest with a reasonable aptitude for subjects which attract him."

To give maximum opportunity to people joining the **United States Rubber Company,** the corporation has a training program geared to the needs of each individual. "As the man grows in ability," H. E. Humphreys, Jr., pres-

E. R. Squibb and Sons

Girl technician preparing a test on the nutritive value of a protein. She uses an instrument called a Tiselius cell in a water bath.

ident and chairman of the board, told us, "opportunities for advancement open up for him. We have never been afraid to extend responsibility to younger men and women, and our management people have reached their present positions through promotion from within the company."

Mr. Humphreys pointed out that at U. S. Rubber it is not a person's particular college degree that counts. "Although a good educational background is becoming more and more essential," he said, "what is really important is the person himself, his abilities, and his sincere desire to contribute something to the company's progress."

What are the job opportunities for research scientists and engineers? One of the most serious problems at the **Bendix Aviation Corporation** is the shortage of graduate and experienced engineers and scientists. "We have requirements," L. A. Hyland, vice-president of Bendix, told us, "for several hundred engineers and scientists that we cannot fill because there simply aren't enough to go around. We want to encourage in every way possible high school graduates with technical aptitudes to continue their training and get a college degree."

Individual vs. Teamwork

Successful research is frequently the product of team work. But how about the fellow who likes to work alone—the lone wolf?

"While team or group research has come steadily to the fore," we were informed by Dr. E. W. Engstrom of the **Radio Corporation of America** laboratories, "there will always be a definite need and place at our laboratories for the scientist who is best suited for individual research. RCA gives a scientist freedom of action. After he has started an investigation he can carry it out independently."

At RCA education is regarded as a process that goes on all the time. It includes not only the work a man does to keep abreast of his field, but also study at the university. Many of RCA's research workers do graduate study for advanced degrees with the encouragement, and frequently the financial assistance, of the corporation.

Research is the lifeblood of industry. P. B. Lewis, personnel manager of **E. I. du Pont de Nemours & Company**, told us a very illuminating story that illustrates its importance.

During the depression years of the 1930's, Mr. Lewis related, when Lammot du Pont was president of the company, he noted that the research budget had been drastically pared for reasons of economy. "We must not reduce this department. It is more important to carry on research," Mr. du Pont told the research director, "than it is to pay dividends."

Research Essential to Progress

The wisdom of that statement is proved by the fact that within recent years about half of Du Pont's sales have come from products that were unknown or in their commercial infancy twenty years previously.

"It is just as certain," Mr. Lewis said, "that the contributions of research during the next generation will dwarf the marvels of the past."

Addressing himself to students in high school today, Mr. Lewis added, "They will, if enough of you who are now in school accept the challenge. Not all of you, to be sure, will or should become scientists or engineers. But you who have inquiring, creative minds; who have patience and persistence; who find satisfaction in the study of science and mathematics—you are the ones upon whom America depends to discover and develop the things which will provide better living in the days to come."

Mr. Lewis is not alone in his opinions. "Without research and development," said Walter A. Sheaffer II, president of the **Sheaffer Pen Company**, "industrial stagnation soon results." "Research work," we were told by P. C. Spencer, president of **Sinclair Oil Corporation**, "offers a challenging and rewarding field for young people. It deserves the deep consideration of all those now making their career plans." Sinclair Oil maintains fellowships in thirteen of the nation's large universities, to sponsor promising graduate students for additional studies in such fields as chemistry, chemical engineering, and geology.

But it is not only the graduate student in a university who is given opportunities to forge ahead. At the **United States Steel Corporation**, high school graduates who want to take college training can make arrangements to work in a laboratory or mill during vacation. They can work in the daytime while attending college courses in the evening.

Some courses for which college credit is given are held in U. S. Steel Corporation buildings by special arrangements with cooperating universities. In addition, the corporation has a scholarship plan. This plan makes it possible for some of its employees to attend college part time at little or no expense.

Again and again leaders in research emphasize science and mathematics.

"Young people in high school who enjoy science and mathematics," we were told by Dr. E. C. Bain, vice-president in charge of research at U. S. Steel, "should consider research and development as a career." However, in addition to the academic requirements for success, Dr. Bain stressed the importance of what he called "vast curiosity and a desire to understand and explain."

"Young people who aspire to a scientific career," Mr. Walter Sheaffer reminded us, "ought to be aware of the sometimes tedious extent of work required to gain the factual knowledge necessary for their advancement."

And there are rewards greater than simple financial ones. "There is," Dr. Bain went on to tell us, "the opportunity of being first to develop a new product or process, or the first to discover some important scientific relationship. The true research man may find satisfaction in such laudable distinctions more than in any monetary return."

General Electric Co.

Schenectady (N. Y.) high school students demonstrate the boiling point of liquids at various altitudes, guided by their physics instructor.

WHY RUN AWAY FROM MATH? Without it, you're a back number in this exciting technical era . . . it's the basic language of science and engineering . . . and it's no tougher than you think it is!

By CHESTER H. LANG
Vice-President, General Electric Company

Stick to Your Math!

LET'S face it. Unless you're an exception, you need more math.

The world today is pretty complicated. Forty years ago there weren't many scientists or engineers. Automobiles were just getting started. Airplanes were a novelty. Radio and television hadn't been born yet. Most homes had no electricity. People got their light from oil or gas. They cooked on a wood, coal, or gas stove. The scrubbing board and the muscle-powered washing machine were something to dread and kept out of sight till Monday morning.

In those days not many technical people were needed. In 1910 over a third of all employed persons were unskilled. They needed very little education. They worked mostly with their muscles, not their brains. Then that unskilled third numbered 13,400,000. Today there are but 11,500,000 of these unskilled persons, while the total number of people working has increased from 37,000,000 to 62,000,000.

Back in 1910 there were only 60,000 engineers in the whole United States—only one out of every 621 people working. But by 1950 they had increased to 400,000—one out of 139 people working.

We Need More Trained People

Yes, the world's getting more complicated all the time. This means that we have to have more and more specially trained people. We need them not only to work out the really tough problems of industrial research, like learning how to harness the power locked up in the atom. We need them not only to produce new and wonderful materials like plastics, to find ways to conquer disease, to design the machines of industry and the labor-saving gadgets of the home. We need them more and more for the ordinary things of everyday life.

It takes training nowadays to be a good carpenter, or plumber, or automobile mechanic. But those are simple compared to electronics. We used to think a radio service man had to have a pretty special kind of training, but it's much tougher for a TV service man today.

Some of you are probably saying: "That's all right if you want to be a technical man, but I want to be an artist, a druggist, a nurse, or I want to go into business for myself. What earthly good will math do me?"

Most artists today go in for applied art. They want to use their ability to draw or paint in advertising, or interior decorating, or something that will pay them a good living. But the people in business who hire the artists for that kind of work say that artistic ability is not good enough any more.

Karsh-Ottawa

CHESTER H. LANG

Before assuming his duties in 1951 as General Electric's Vice-President in Charge of Public Relations, Mr. Lang was Vice-President and General Manager of Apparatus Sales. Though no engineer himself, he has spent a large portion of his life reading engineering reports and working with engineers and executives. From his rich experience he speaks to boys and girls in the schools and colleges of America.

There are lots of boys and girls with artistic ability, but not enough of them know anything about physics or mathematics or mechanical things.

To be a druggist, you have to be a chemist. That means you have to study chemistry. And don't let anybody tell you that you can learn chemistry without knowing something about algebra.

How about a nurse? One of the required subjects in a course of nursing in a modern hospital is Materia Medica. In Materia Medica you'll learn how to figure out doses and solutions of medicines and drugs. Algebra is important in doing the figuring. Too many nurses in training flunk out nowadays because they are weak in math.

It's the same with a trade. Whether you want to be a draftsman, a machinist, a molder, or a patternmaker, you'll find that you need algebra and geometry, plus some trigonometry.

Even if you want to enter business for yourself, you'll need math. For business today, whether it's running the little gas station at the corner or the big factory down by the river, takes good management, and good management requires a mathematical mind.

But most important of all are the needs of those who are going to contribute to the wonderful progress we're making these days in science and engineering. There's a great demand for such technically trained people. They're needed in the offices and factories that turn out the things we need in peacetime and develop the new ones for tomorrow. And our military forces need them, too—badly. They are needed to pilot the planes, to operate the radar, to control gun turrets on bombers and battleships with such accuracy that even the rotation of the earth is taken into account.

There aren't enough trained people to go round. The jobs are there, waiting for them when they get out of high school or college. But not enough young people are studying the right things.

THESE OCCUPATIONS NEED

Lots of Math	*More Than Average Background in Math*	*Just a Little Math*
Architect	Accountant	Clergyman
Aeronautical Engineer	Nurse	Telephone Switchboard Operator
Research Scientist	Patternmaker	Lawyer
Marine Engineer	Teacher	Baseball Player
Ceramic Engineer	Merchant	Farmer
Surveyor	Physician	Photographer
Chemist	Machinist	Reporter
Mechanical Engineer	Draftsman	Filling Station Attendant
Electrical Engineer	Airplane Pilot	Policeman
Geologist	Commercial Artist	Fireman

Do you agree with these listings? Can you make these lists twice as long by naming other jobs?

Trouble is, they don't start early enough. That means that if you want to be an engineer or a scientist or almost any kind of specialist these days, you've got to start thinking about it now, while there's still a chance to study those subjects you need for a foundation.

And the most important of these rock-bottom subjects is mathematics.

Better Education—Better Jobs

But the fellows and girls in high school aren't getting enough math. The United States Office of Education says that only 20 per cent of all high school students are taking math. Why so few?

Perhaps you think you're not going to need math in the work you're going to do. And it's true there are still plenty of jobs open where you don't need anything but plain arithmetic—an athlete, for example, or a farmhand, or a sales clerk, or the operator of a telephone switchboard. There is still a big need for people who are merely skilled with their hands or who have strong muscles.

But if your ambition makes you dream about a more challenging job, you will need a better education. And that means math, among other things. Of course there are many other subjects you need to know to be a well-rounded person—English and history, for example, psychology and languages. They help us to enjoy our leisure, to understand and work with others, to gain a sense of values. We need to be good citizens as well as good technicians. But don't forget math!

Even if your future job requires but little arithmetic, it may be that you are the kind of person who needs mental curiosity to get the most out of life. You may be one of those people who are not content to go on living, just having an amusing time and not caring about anything else. You will be driven by your mind to find out what makes the wheels go round—what makes it rain or snow, why mirrors reflect light, or what makes TV work.

If you are that kind of person, you almost have to learn something about the more advanced branches of mathematics if you want to understand the things you are curious about. If you are curious about the distances to the sun or the moon or the stars you've got to know something about trigonometry. If you want to understand the laws that govern the workings of the universe which includes these heavenly bodies, you have to understand calculus.

Suppose your interest is in economics. That's the study of such things as inflation and banking, whether we're going to have enough food or machines to go round, and what we're going to use for money. The fellows who study economics are great ones for graphs and curves, to make statistics easy to understand. All this comes under the head of analytical geometry, a very handy subject to know.

Some people think of math as something mysterious, something that only "brains" can get good marks in. Well, if that's the way you feel about math, you're wrong.

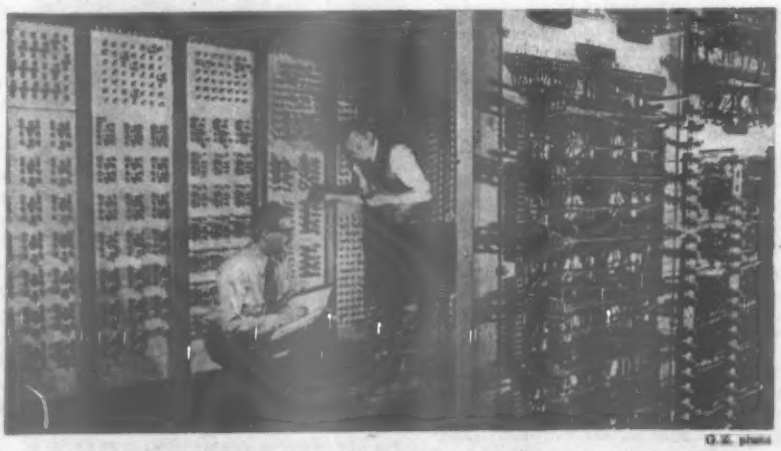
What Is Math, Anyway?

Actually—and I have checked this with some of my company's best "brains"—mathematics, no matter how advanced, no matter how strange it may seem, is just the four simple parts of arithmetic: addition, subtraction, multiplication and division. The more advanced branches of mathematics teach you how to use these four processes to solve harder problems; and they teach you how to do them *fast*.

For we use the simple kinds of math as stepping stones to reach the more complicated kinds. Once we learn addition, subtraction, multiplication, and division, it's easy to learn algebra. Once we learn algebra, it's easy to learn geometry. Logarithms are just a kind of shortcut to help solve problems in arithmetic. Algebra's another shortcut.

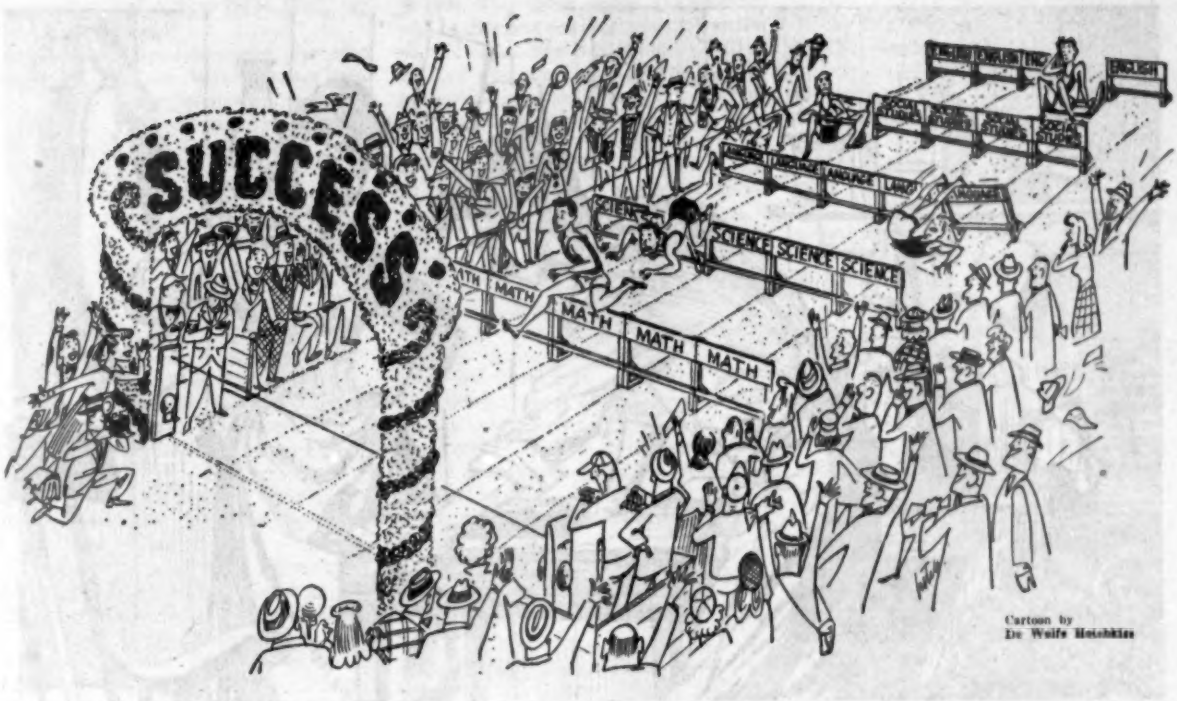
Geometry, however, isn't really mathematics at all. It's a logical study of the shapes and sizes of things. We use mathematical skill in figuring out the measurements and capacities of geometrical figures—how big they are or how much you can put into them.

Trigonometry is the next stepping stone. It uses some of the tools we learned in geometry for measuring distances. With it we can do surveying, or measure the distance from the earth to the moon, the sun, or even some



G.E. photo

This G-E electronic computer arrives at the answer to a complex problem about 5,000 times faster than a human being. But this machine is no better than the minds that designed it. Somebody has to analyze the problem and feed it into the machine before the machine can solve it.



of the stars. But when you solve a trig problem you still use arithmetic: addition, subtraction, multiplication, and division.

And calculus is a very wonderful branch of math. While geometry and trig are used to figure out problems about things that are standing still, so to speak, calculus is used to solve problems about things that are always changing—like the speed of an airplane's flight against a head wind. Yet calculus is just one more elaborate method of using addition, subtraction, multiplication, and division.

Of course, formulas and symbols scare us. That is because we don't know what they mean. But there's really nothing to be scared of. They are only simple shorthand ways of writing complicated ideas or methods of solving problems.

People who study physics have proved by experiment that if you're trying to hit a home run, it's more important to hit hard than it is to use a heavier bat. When you hit with something twice as heavy, it does twice as much good. But when you hit twice as hard, it does four times as much good. When you hit with something three times as heavy, it does three times as much good. But when you hit three times harder, it does nine times as much good.

Here is a formula: $E = \frac{MV^2}{2}$

That's what the last sixty words of the previous paragraph were trying to tell you. Translated, this formula says that Energy equals half the product of Mass times the square of the Velocity.

If you know what the letter symbols mean, and you have studied algebra, you can understand what most formulas mean.

The Most Important Part of Mathematics

When we have a problem, or something happens in a series of developments, and we have to figure out what to do next, that's called analysis.

Your arithmetic, algebra, geometry, and calculus are the *tools* you use to solve problems. But you can't use the tools unless you *analyze* your problem first to see what you've got, what you need to do, what tools to use, and how you should go about it. Analysis is the most important part of math.

For example, if you want to know what percent 48 is of 60, it's analysis that tells you to divide 48 by 60 to get the answer (80%). Analysis told you whether to use a guessing method or algebra. You solved the problem while you were analyzing it.

Professor Benjamin F. Bailey of the University of Michigan said something about that in an article he wrote not long ago. He said that education is mainly composed of learning facts, learning to get along with other people, and learning to think better. All of them are important. Now all people think, but some do a lot more of it, or do it better, than others. Professor Bailey wondered why some people thought better than others. He said the first thing necessary to be a thinker is to be born that way, like Franklin or Edison. But that doesn't mean that people can't be taught to think—or to think better. Bailey mentioned some well-educated people—Elihu Thompson, Steinmetz, Langmuir, and Coolidge. Their education, far from interfering with their ability to think, must have been a great help to their thinking ability.

Then Professor Bailey wondered what studies in school helped most in developing the habit of thinking. The first of these, he concluded, is arithmetic. Here the pupil learns to think accurately and logically—probably for the first time. Mathematics is not the only subject that helps to develop more logical thinking. You need to know many ideas in the arts and social studies that cannot be measured by arithmetic. But all scientific knowledge can be reduced to the most important tool to help us see the relations between things.

So it's to your advantage to study as much math as you can while you still have the chance. And the best time to get a good groundwork in math is while you are still in junior and senior high school. You'll find it much easier to get through college if you get a good groundwork in math now. And it will help you get a better job afterwards, too. Most important of all, it will help you to think more clearly, and to get the most out of life.

Metal of the Moon

A Radio Play on the Discovery of Aluminum

By IRVE TUNICK

ANNOUNCER: Tonight's Du Pont Cavalcade "METAL OF THE MOON" stars Montgomery Clift as Charles Martin Hall. The story begins on a September day of 1884 in the little town of Oberlin, Ohio. It was warm . . . but not hot. Down from Lake Erie, some twenty miles to the north, a wisp of wind tickled the elm trees along College Street, patted the flag of the campus of Oberlin College and, finally, meandered off rather aimlessly to the south. It was a good day for a nap. . . . Then—

(Banging of iron-ring fire alarm . . . hold . . .)

CHIEF (*shouting*): Fire! Fire! Fire!

(Running footsteps, wheels on ground . . .)

SLOCUM: Where is it, Chief? Where's the fire?

CHIEF: The Hall House on College Street . . . young Charlie Hall must be experimenting again!

(Bell on fire-truck clangs as)

(Music: Covers quickly in and out)

CHARLIE: Golly . . . what a mess. Julia . . . Lou . . . Will you help me clean things up?

JULIA: How did the fire start, Charlie?

LOUIE: What happened?

CHARLIE: I don't know. I was working on a chemistry experiment. I decided I'd try . . . something different from what the book said . . . and then . . . Boom!

LOU: When Father gets home . . . that's what'll happen.

CHARLIE: What'll happen, Sis?

LOU: Just what you said: Boom!

(Music: bridge . . .)

FATHER: Charles . . .

CHARLES: Yes, Father . . .

(Giggle of girls in background)

FATHER: Arumph . . . Charles . . . May I ask you how the fire started?

CHARLES: Well . . . I don't know exactly, sir. You see, I was mixing some chemicals . . . doing an experiment . . . and . . . all of a sudden . . .

FATHER: All of a sudden . . . what?

CHARLES: Fire.

FATHER: Humph.

JULIA: It wasn't Charlie's fault, Father . . . it was just an experiment . . .

FATHER: Julia . . . you and your sisters will kindly let me handle this matter in my own fashion.

JULIA: Yes, Father.

FATHER: Now, Charles . . . your mother and I have been most indulgent in the matter of your chemical experiments. That's true . . . is it not?

CHARLES: It certainly is!

FATHER: We have maintained an attitude of quiet resignation in the face of alternating periods of abominable smells and malodorous gases. When acid dripped down from the attic . . . went through the floorboards and ultimately dug a hole in mother's favorite counterpane, we said not a word.

CHARLES: No, sir . . . not a word . . .

FATHER: You would say, then, that we . . . as parents . . . have been sympathetic?

CHARLES: Sympathetic. No question about it.

FATHER: Good. But, Charles, one has to draw a line somewhere.

CHARLES: One does, yes sir.

FATHER: Setting the house on fire . . . that is just a trifle too much.

CHARLES: I would think so.

FATHER: Good. Then you will understand exactly why I say to you at this time that you are never . . . *never* . . . *never* to conduct another chemical experiment *under this roof*!

CHARLES: But, Dad—

FATHER: There is no appeal from this decision. Good day, Charles. Good day, children.

(Music: tag . . .)

(Footsteps . . . door open and close)

JEWETT (*off mike a bit*): Well, Mr. Hall . . . Come in.

CHARLES: Good morning, Professor Jewett. I hope you don't mind my bothering you in your laboratory.

JEWETT (*on mike now*): Nonsense. Say, what's this I hear about a fire at your place?

CHARLES: One of my experiments—

JEWETT: Oh. That will happen.

CHARLES: It sure made a mess of things.

JEWETT: Sorry to hear that.

CHARLES: I've been banished.

JEWETT: Tsk-tsk . . .

CHARLES: I can't work at night any more. I got kicked out of the attic.

JEWETT: Hmmmm. Hard to work in chemistry without a laboratory.

CHARLES: It sure is. What am I going to do?

JEWETT (*after pause*): How'd you like to work here . . . in your free time?

CHARLES: Could I, sir?

JEWETT: Well, why not? All we need is the permission of the head of the Chemistry Department of the College.

CHARLES: But, Professor . . .

JEWETT: I know. I'm the head of the Chemistry Department of the College. Very well . . . permission granted!

(Music: Tag in and out)

(Sound: Laboratory noise . . . faint hum of motor in background . . .)

JEWETT: Charlie . . .

CHARLES: Yes, Professor Jewett?

JEWETT: It's stifling in here. Would you mind opening a window . . .

CHARLES: Not a bit . . .

(Footsteps . . . window open . . . little whine of wind . . . rattle of papers . . .)

JEWETT: Oh . . . watch the papers on my desk . . . (*Little scramble as they both rush to hold papers down*) Hand me that paperweight . . .

CHARLES: This it? Here you are, sir.

JEWETT: . . . Thanks. (*Pause*) What are you looking at, Charlie?

CHARLES: That paperweight. I thought it was lead. But when I picked it up . . . But it doesn't weigh anything.

JEWETT: Oh. That's not lead, my boy . . .

CHARLES: What is it?

JEWETT: That's one of the crown jewels of chemistry. Aluminum, Charlie . . . *pure aluminum*. One of chemistry's will-o'-the-wisps.

CHARLES: I've never seen *pure* aluminum before.

JEWETT: Not many people have. It's almost a laboratory curiosity. What a pity! A strong, wonderful metal . . . lighter than iron, copper, zinc or lead . . . resistant to corrosion . . . by water or air. But a baffler . . . a real puzzler, Charlie.

CHARLES: Why . . . what's so puzzling about it?

JEWETT: It's modesty, if you can call it that. This thing called aluminum is one of the most common elements in the earth's crust. Every clay bank is full of it. But you can't get it out just by issuing a polite invitation. It never occurs in its natural state . . . as pure aluminum . . . it's always bound up tightly with other elements and no one as yet has ever found a method of extracting it economically . . . getting it out in a pure state at a price low enough to make it economically feasible.

CHARLES: Can't they find anything that will reduce those compounds?

JEWETT: No, indeed. Some of the greatest chemists of the world have tried and given up . . . Charlie, here's something to think about: The man who finds a way to extract aluminum from its compounds on a commercial scale would be a benefactor to the world and . . . incidentally . . . lay up for himself a great fortune. (*Pause*) I mean that, Charlie. I'm serious.

ACKNOWLEDGMENT

This dramatic story of the discovery of the electrolytic process of aluminum reduction by Charles Martin Hall, a young Oberlin College student, in 1885, was originally presented over the air as a unit in the Du Pont "Cavalcade of America" program (NBC), on January 23, 1951. The process, later developed commercially by Capt. A. E. Hunt and George H. Clapp of Pittsburgh, was the basis of the productive power of the Aluminum Company of America.

"Metal of the Moon" is here reprinted through the courtesy of the Du Pont Company, sponsors of the "Cavalcade of America" radio and television programs. It may be presented by high school groups over local broadcasting stations without royalty, provided a suitable acknowledgment is given as above.

All other rights reserved.

CHARLES: It sure is something to think about. It sure is.

(Music: In and out . . .)

(Running water and clatter of dishes)

(Door opens off mike)

CHARLES: Hiyah, Julia . . .

JULIA: Hello, Charlie . . .

CHARLES: Nobody home?

JULIA: Just me . . . and this mountain of dishes.

CHARLES: I'll give you a hand . . .

JULIA: I don't mind the dishes . . . But those big iron pots . . . I can't even lift 'em.

CHARLES: Here—I'll wash—you dry.

JULIA: I'd be crazy to say no. I yield to the gentleman from South Carolina . . .

CHARLES (*mock Southern*): Thank you, ma'am. Does this pot have to be washed?

JULIA: Unless you want to take it out in the back yard and bury it.

CHARLES: That's an idea. (*Footsteps . . . little bang of metal*) Boy, this thing must weigh 15 pounds if it weighs an ounce. Why don't they make lighter pots?

JULIA: It would be a boon to humanity. Women around the world would beat a path to the door of the man who would make a lighter pot.

CHARLES: Well, that should be an inducement.

(Pumping stops . . . swishing of water)

JULIA: By the way . . . Heard from Ellen lately?

CHARLES: Uh? From who?

JULIA: Ellen . . . Ellen Franks . . . Remember . . . the girl from Cleveland . . . the girl you couldn't stop talking about last summer.

CHARLES: Oh. No.

JULIA: Now, look here, Charlie . . . what in the world is the matter with you?

CHARLES: Why? Everything's fine.

JULIA: It is not. You're not yourself. Don't tell me . . . I know you like a book. Something's come over you lately. You're so quiet . . . and always by yourself. You don't even play the piano any more. What is it?

CHARLES: I don't know, I don't know what's the matter with me. I'm twenty-one. I'm a junior in college. I live in a plain house in an ordinary town . . . I should be just a plain, ordinary fellow. I should be thinking about girls, about sports, that sort of thing. But I don't. What's the matter with me? I've got one thing on my mind—chemistry!

JULIA: Why?

CHARLES: I don't know why. But I wake up in the morning thinking chemistry . . . all day, no matter what else I'm doing. I'm thinking out chemistry problems. At night, do I go to sleep reading a novel? No—chemistry books! Today Professor Jewett spoke about aluminum. He said that chemists have been trying for years to find some way of getting it out of its compound by some method other than reduction—which is too expensive and so no good commercially.

JULIA: Well?

CHARLES: I went to the library—got all the books I could find on the subject. It sounds crazy . . . But I intend to go after that metal.

JULIA: What's crazy about that?

CHARLES: Well, gee, I'm a student . . . and for years the best chemists in the world have been trying to find the answer. They can't . . . yet I'm going to try.

JULIA: Good. It'll take time, of course. You'll have to finish college . . . take postgrad work . . . then get into a laboratory . . .

CHARLES: I don't mean that. I mean that I'm going to try it now.

JULIA: Well, all right... work here...

CHARLES: Here? After what Father said . . .

JULIA: He said you couldn't work with chemicals under this roof.

CHARLES: He wasn't fooling either.

JULIA: What's the matter with the woodshed in back?

CHARLES: The woodshed?

JULIA: It's not under this roof . . .

CHARLES: Julia... you're a genius...

JULIA: Uh-huh. I'll leave that title for you. Come on . . . help me hang this pot over the stove . . .

(Footsteps)

CHARLES: You think I can do it, don't you, Julia?

(Sudden crash of pot to metal stove)

JULIA: Ow! Right on my foot!

CHARLES: Gee, did you hurt yourself, sis?

JULIA: It wasn't your fault, but I tell you this, Charlie Hall . . . you hurry up and find out how to get aluminum . . . and the first thing you do with it is make some lighter pots!

(Music: bridge)

FATHER: Mother!

MOTHER: Yes?

FATHER: My lemon drops aren't in the pantry.

MOTHER: Oh . . . they must be.

FATHER: They're not.

MOTHER: Let me see. (*Footsteps . . . pause*) That's funny . . . my cookie jar is gone, too.

FATHER: They were in a glass jar . . . as always . . .

MOTHER: I can't understand it. For the past few days all of my glass jars have been disappearing.

FATHER: Indeed?

MOTHER: Oh, well . . . it's nothing very important . . .

FATHER: I insist it is important. What is the world coming to when a man's lemon drops aren't safe . . . even in his own home!

(Music: tag . . .)

(Tinkle of glass)

LOUIE: Will someone please tell me what's going on in this woodshed . . . and why you need all these glass jars?

CHARLES: Is that all you two could find?

JULIA: Charlie Hall . . . there isn't a glass jar left in the house . . . I'll take an oath on that.

LOUIE: I want to know what's going on here!

CHARLES: Making a battery, Louie...

LOUIE: A battery . . .

CHARLES: For current . . . electric current . . .

LOUIE: Oh.

CHARLES: Julia . . . mash up some of that aluminum oxide?

JULIA: All right . . .

LOUIE: What do you want electricity for?

CHARLES: Lou, can you keep a secret?

LOUIE: Uh huh, sure. You can trust me.

FATHER (*off mike*): Secret? And may I ask the nature of this secret?

JULIA: Father! Oh, gee!

(Footsteps in)

MOTHER: My cookie jar!

FATHER: My lemon drops!

LOUIE: My goodness!

FATHER: Charles . . . Julia . . . Lou—I think an explanation is in order.

LOUIE: I'm innocent.

CHARLES (*smiles*): Well, Father, you said I mustn't experiment in the house—so, I'm here in the woodshed.

FATHER: I am eagerly awaiting the explanation.

CHARLES: Well, the explanation is pretty simple, Father. It's one word.

FATHER: One word?

CHARLES: Aluminum.

JULIA: It's a wonderful idea . . . it really is, Father. Look at this little paperweight Charlie got from Professor Jewett. It's pure aluminum. Feel how light it is . . . one-third the weight of steel . . . yet it's strong enough to make a bridge... or girders for a building...

FATHER: All right, but I still don't understand. Not a bit. If there's a need for aluminum, why fool around with all these glass jars, why not just mine the stuff . . . like iron or copper?

CHARLES: Can't be done. You see, aluminum never occurs in a natural state. It's always wrapped up tightly with other elements, often in complicated compounds.

FATHER: And you think you can find a way to get it out of these compounds out here in the woodshed?

CHARLES: I think so. I think I've got at least part of the answer. You see, Father, everyone else has tried to get aluminum by chemical reduction. I want to try something new . . . electricity! My idea is that a strong electrical current can break down the compounds . . . separate aluminum from all the other elements . . . get it out in a pure metallic state . . .

FATHER: Have you talked this over with anyone qualified to judge the merits of your theory, Charles?

CHARLES: Yes . . . with Professor Jewett.

FATHER: And what does he say?

CHARLES: He says I may be on the right track.

FATHER: I think I made myself clear on the matter of chemical experiments at home, Charles . . .

CHARLES: You said not under the house roof.

FATHER: So I did.

JULIA: This woodshed isn't under the house roof, Father.

FATHER: A technicality.

CHARLES: I suppose you want me to quit.

FATHER: Quit? You're not the kind that quits, Charles. No . . . I don't want you to quit . . . I want you to keep right on going. But Charles . . .

CHARLES: Yes, sir.

FATHER: I will ask you one favor.

CHARLES: Of course, sir . . .

FATHER: Will you be good enough to turn back to me the lemon drops that were in my glass jar!

(Music: Tag . . .)

ANNOUNCER (*music*): It's a year later, 1885. Charlie Hall has graduated now and in a battered old woodshed behind his house in Oberlin, Ohio, he is still searching for the secret of aluminum.

(Sound: Crackle momentarily... door open off mike . . . footsteps in . . .)

JULIA: Hello.

CHARLES: Hi—sis—

JULIA: Any luck?

CHARLES (*sighs*): Nope. I can't seem to find the right thing to get the aluminum oxide in a molten state . . .

JULIA: What next?

CHARLES: You tell me.

JULIA: The next thing is a hayride.

CHARLES: A what?

JULIA: A hayride. Come on, Charlie . . . we're all going! It'll be fun.

CHARLES: Oh, no . . .

JULIA: Charlie . . . listen . . . you've been cooped up in this woodshed for months now . . . it's bad for you.

CHARLES: I gotta get to the bottom of this.

JULIA: It's smothering you. You can't think clearly about it any more because you've been so wrapped up in everything. You need some time off . . . your brains need a vacation.

CHARLES: Well, I'd say that a hayride is a type of ambulating crucible in which various explosive chemicals react against one another.

JULIA: React or attract?

CHARLES: . . . that's a good question. All right . . . suppose we find out!

(Music: Tag into . . .)

(Hayride wagon creaking along)

(Boys and girls singing popular song of the day)

SYLVIA: Why so quiet, Charlie?

CHARLES: Nothing to say, Sylvia.

SYLVIA: I was surprised when Julia brought you along.

CHARLES: Were you?

SYLVIA: Um-hum.

CHARLES: Glad?

SYLVIA (*slightly different tone*): Um-hum.

CHARLES: I'm glad Julia brought me along, too.

(Singing in background up . . . creaking of wagon up . . . then dip again . . .)

SYLVIA: What are you thinking about, Charlie?

CHARLES: Hmmm . . . nothing 'special.

SYLVIA: You know what I'm thinking about?

CHARLES: Tell me.

SYLVIA: The moon.

CHARLES: The moon? Same old funny lookin' moon.

SYLVIA: No, it isn't. Tonight it looks different somehow. Bigger than ever . . . whiter than ever . . . just a big round rock of ice.

CHARLES: A rock of ice . . .

SYLVIA: Hmmm.

CHARLES (*suddenly alive*): Rock ice!

SYLVIA: That's what it looks like.

CHARLES: Rock ice! Sylvia . . . Thanks a lot!

(Slides off wagon . . . running footsteps . . . off mike yells) Goodbye!

SYLVIA (*alarmed*): Charlie . . . what's the matter? What is it? Charlie!

JULIA: Sylvia? What happened? What happened to Charlie?

SYLVIA: I don't know. I didn't say anything . . . I didn't do anything . . . and Charlie ran away!

(Music: Tag . . .)

(Lab noise . . . tinkle of glass, etc.)

JULIA: You should be ashamed of yourself, Charlie Hall . . . running back to the woodshed that way.

CHARLES: I'm sorry, Julia. I'll make it up to her. Get to work and mash some aluminum oxide for me, will you?

JULIA: I will not . . . until you tell me why you ran away.

CHARLES: Rock ice! That's what Sylvia said . . . and that will do the trick.

JULIA: Rock ice?

CHARLES: Ever hear of it?

JULIA: No.

CHARLES: That's what they call cryolite . . . rock ice. And cryolite is just what I need as a solvent for the aluminum oxide. Unless I miss my guess, aluminum oxide will dissolve it . . . giving me what I want—a melted mass containing no water. Now . . . I'll heat the clay crucible and you get to work on that aluminum oxide—

(Music: Tag . . . into ticking effect as of clock . . . down and out . . .)

JULIA (*yawns*): I'm tired.

CHARLES: It's late.

JULIA: It's almost an hour since we poured the mixture out of the crucible into the cooling pan . . .

CHARLES: Let's take a look. Give me the hammer.

JULIA: What should happen, Charlie?

CHARLES: Well, if things are right . . . somewhere in this cake of hardened cryolite we should find some pure metallic aluminum. Let's see . . .

(Begins to hammer)

It breaks up easily, you see.

JULIA: Do you see anything?

CHARLES: Not yet.

JULIA: What will it look like?

CHARLES: Probably . . . little buttons of aluminum . . . like little beads.

(Bangs more . . . pause . . . again . . .)

JULIA: Well?

CHARLES: Nothing.

(Hammers again)

No use. Nothing . . . not a trace of aluminum.

JULIA: Not even one little bead?

CHARLES: Nothing. (*Pause*) Well . . .

JULIA: What went wrong, Charlie?

CHARLES: Something . . .

JULIA: But everything seemed exactly right. The cryolite melted down . . . the aluminum oxide dissolved . . . maybe you didn't have enough current.

CHARLES: No . . . it's not that.

JULIA: Then what?

CHARLES: I don't know. But somewhere along the line—Let's see . . . let's go back step by step . . . First, we crushed the aluminum oxide . . . that was all right. Then we melted down the cryolite. That went all right. We put the aluminum oxide into the crucible and . . . (*Stops*) . . . the crucible!

JULIA: There was nothing wrong with the crucible, Charlie. It stood up fine . . .

CHARLES: The crucible. It was made of clay. Maybe something in that clay reacted with the aluminum and spoiled the experiment. We've got to find another type of crucible . . .

JULIA: What kind?

CHARLES: Carbon.

JULIA: Why carbon?

CHARLES: Because carbon is chemically stable. And a crucible made of carbon won't have anything in it to prevent the electric current from separating the aluminum from its compound. Come on—let's get to work.

(Music . . . again clock effect . . . slowly out . . .)

(Rooster off mike)

JULIA: What's he got to crow about?

CHARLES: More than we have . . . so far.

JULIA: Can we try now?

CHARLES: What do you think?

JULIA: I can't even think, Charlie . . . I'm afraid to think.

CHARLES: Remember the little poem we used to say when we were kids, Julia . . . when we wanted something real bad?

JULIA: Yes . . .

CHARLES: Say it.

(Starts pounding with hammer)

JULIA: I hope it's white . . . I hope it's blue
I hope that all my dreams come true . . . (*repeat*)

CHARLES: Julia . . . look!

(Pause)

JULIA: Beads . . . a lot of beads . . .

CHARLES: Aluminum . . . pure aluminum . . .

JULIA: Like jewels . . .

CHARLES: The crown jewels, sis . . . look at them . . . the crown jewels of chemistry! Pure aluminum!

(Music: Tag . . . full . . . under . . .)

From Formula to Fiber

A Picture Story of Nylon

CHEMIST Wallace Carothers (who died in 1937) directed Du Pont experiments that led to nylon.

TECHNICIAN tests new experimental fiber on Du Pont lab equipment. To be accepted, nylon had to "pass" similar tests.

NYLON is a man-made (synthetic) fiber that was born in a chemist's laboratory only twenty years ago. How nylon grew is one of the most amazing "success stories" of U. S. industrial research.

It all began in 1928, when the Du Pont Company told a team of its research chemists: "As you know, nature builds the big 'fiber' type of molecule (such as those of cotton and silk) by linking smaller molecules together in long chains. Find out all you can about this process."

The chemists set to work. By 1930, they had learned enough to begin making new types of "long-chain" molecules themselves. In 1935, they came up with nylon—a chain of more than 100 molecules of hexamethylene diamine and adipic acid. (These are chemical substances produced from air, water, coal, and oil.)

(In the photo at the top of the page, you see the beginnings of the man-made fiber, nylon—in the test-tube of a research chemist.)

Nylon fiber, the chemists found, was strong, elastic, light in weight. Also, it "wore like iron."

The next question was: "Could nylon be mass-produced as yarn for making textiles?" After four more years, the labors of 250 researchers in thousands of experiments, and the spending of millions of dollars, Du Pont came up with the answer: "Yes!"

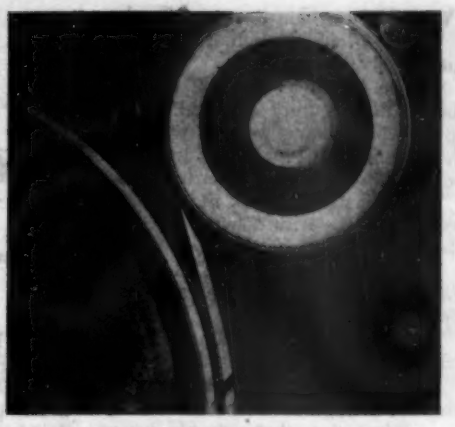
Du Pont swung into commercial production of nylon in 1939. Nylon won success as a textile for women's stockings. Other uses followed. The "test-tube miracle" grew to be one of the leading textile fibers in the world.

Since nylon's birth, chemists have created a whole new family of synthetic fibers. You've seen their names in the textile ads—orlon, dacron, dynel, acrilan, vicara, etc. Today, about one fourth of the fibers we Americans use are of the man-made type.

Our world has more than 90 chemical elements. Only the tiniest fraction of their possible combinations has been tested for commercial use. Researchers of U. S. chemical companies are hard at work, seeking new materials, new products for a higher standard of living.

(The photos on these two pages, furnished by courtesy of the E. I. du Pont de Nemours Company, Inc., show how nylon began and how it is manufactured today.)

BOILED: In giant "pressure cooker," called *autoclave*, small molecules are heated until they link up in long chains, forming the big molecules of nylon.



WHIRLED: Nylon pours from "cooker" *(upper left)* onto whirling wheels, solidifies into ribbon, and is again liquefied.

SQUEEZED: Liquid nylon squeezes through tiny holes of *spinneret*, hardens into tiny filaments as soon as it strikes the air.

SPUN: Filaments run through rollers, are spun into nylon yarn. Yarn is stretched (making it elastic), then shipped to nylon users in industry.

USES OF nylon are many and varied. It's fashioned into WOMEN'S STOCKINGS—and stoutly-woven PARACHUTES and MARINE ROPES! Nylon also goes into shirts, dresses, underwear, carpets, upholstery, fish nets, tennis rackets.

People Who Work

The Story of Research at the Corning Glass Works

"WHAT can you do with glass besides look through it and drink out of it?"

Science began asking that question about half a century ago—and opened up a whole new "wonder world of glass." Nowadays, if you ask what you can do with glass, the answer would be:

"You can wear it, cook in it, build a boat or a house with it, whittle it, take photos in it—and that's just a starter."

The glass most of us are used to is stiff, breakable stuff—bottles and window panes, for instance.

But at the Corning Glass Center at Corning, New York, I saw:

. . . Plate glass so springy that it's used for diving boards.

. . . Fiber glass that you can weave on a loom.

. . . Safety glass (glass-plastic "sandwiches") that can stop a bullet.

. . . Heavyweight glass (70 per cent lead) that can stop atomic rays.

. . . Featherweight "foam glass," so buoyant that it's sometimes used in liferafts.

. . . Those new "cousins" of glass—the silicones: They pinch-hit for oil as a lubricant, are used for waterproofing and in varnish, and in another form, have many of the qualities of rubber.

Where did all these new kinds of glass come from?

Corning's "Idea Men"

A lot of them were "born" in an unassuming four-story building set in the midst of the bustling factory area of Corning Glass Works (which operates the Corning Glass Center). Opening off its glass-brick corridors are lab rooms where earnest men in white coats move mysteriously amid a forest of complicated glass apparatus. In book-crammed offices, scientists dream their dreams for an all-glass world.

This is CGW's laboratory building. About half the 300 people who work there are physicists, chemists, and engineers. They're the "idea men" who are building the future of Corning Glass—as they have built its present.

Dr. Edward U. Condon, director of research at Corning Glass Works, told me: "Sixty per cent of Corning Glass Works' business today is in products that didn't even exist commercially ten years ago."

Of the nation's 250 glass factories, employing about 125,000 people, Corning Glass with 14,000 workers is one of the larger units. It is the world's largest producer of technical glass (such as laboratory glass, signal ware, and special glasses for industry and research).

Corning owes its leadership largely to CGW's "wedding" with science. This is the "diamond anniversary" of that wedding. It happened 75 years ago, when CGW was a struggling little factory of about 100 workers. Among its products were signal lenses for railroads. Patterns of ridges were molded on the outside of these lenses. These ridges acted as prisms, to concentrate the light beam in the desired direction. Railroads complained about the lenses. "Dirt and snow collect in the prisms," they said, "and block off the light."

Corning asked a Cornell University scientist for advice. With his help, CGW worked out a way to mold the prisms on the *inside* of the lens. Then the outside was smooth and easily cleaned.

It was the first time the American glass industry had ever called on science to help solve its problems.

Now the lenses were better—but the colors weren't right. They were weak and hard to see. A Yale scientist helped Corning develop a set of signal-glass colors that were adopted in 1907 by all U. S. and Canadian railroads.

Corning and science made their partnership permanent. In 1908 Corning called in a chemist, Dr. E. C. Sullivan, to set up a research laboratory—the first in the U. S. glass industry.

The railroads had still another complaint. "What can you do about those glass chimneys you make for brakemen's lanterns? They're always breaking in bad weather."

Metal, you know, expands when it's heated and shrinks when it cools. Glass does the same thing. What happened was this. The flame in the brakeman's lantern heated and expanded the *inside* of the glass chimney. Rain or snow, beating on the lantern, chilled and shrank the *outside*. This literally pulled the glass apart.

"We'll have to invent a brand-new kind of glass," CGW's scientists decided. They tried adding boric acid to the glass mixture. It worked! The new glass didn't shrink or expand much with temperature changes. After that the brakeman, swinging off his caboose on a nasty night, could be sure his lantern would burn steady and true.

The laboratory kept improving this new glass. Among other things, it was used for storage-battery jars. Dr. J. T. Littleton took one of these jars home with him one day in 1915. The next day his startled co-workers were offered a piece of cake baked in the jar.

Cooking in glass! Nobody dreamed of such a thing before 1915. Nowadays glass cooking ware is in nearly everybody's kitchen.

A "Glass Cookbook"

And CGW goes on "cooking" new glasses. For thousands of years the only way known to make glass was to mix sand, soda, and powdered limestone and

GLASS FOR COOKING: New designs and new ways to use Pyrex baking ware and kitchen glassware are tried out in the Test Kitchen at Corning Glass Works.

GLASS FOR ART: The Paul Revere vase, designed by sculptor Sidney Waugh in "Steuben" crystal—a glass made with lead, for clarity and "sparkle."

in Glass Houses

By STURGES F. CARY

melt them together. (This is still the commonest and cheapest kind of glass.) But Corning stirred in all kinds of other materials. Corning's "glass cookbook" has 50,000 different "recipes."

"Our assignment is to take the whole table of elements and see what we can make," says Dr. W. W. Shaver of CGW's laboratory.

"The industrial laboratory is basic to our competitive free enterprise system. If we didn't have a laboratory, we couldn't hold our own against our competitors. And our competitors are not only glassmakers, but makers of metals and plastics, too. We must have the organization to study our materials and learn how to use them in new ways."

To show where a new idea will sometimes take you, Dr. Condon told me this story:

About 15 years ago Dr. Robert Dalton noticed something interesting: A certain kind of red glass would take on its color more quickly if exposed to ultraviolet light.

CGW scientists wondered: "Is this a clue to a way to make photographs in glass?" Dr. S. D. Stookey went to work. He took certain metals that are sensitive to light and mixed them into the glass.

Before long he had worked out a way to take photos—not *on* glass—but *in* it. These photos don't fade or get dirty. They have a "three-dimensional" look.

While CGW began marketing this "photosensitive" glass, Dr. Stookey was busy with something else. He found that in certain glasses milky particles would grow around the metal particles after exposure to ultraviolet light. He could produce a pattern—any pattern—in the clear glass.

Suggested John Hoxie: "Some buildings have metal louvers over their lights so that the light will shine straight down. Why not make glass louvers right in the glass light fixtures?" So CGW laboratory research created another new product.

But that wasn't all. Dr. Stookey found that acid didn't bother the clear glass, but ate out the milky pattern. Result: The birth of "chemical machining." By photography and acid, Corning can mass-produce a piece of glass with any kind of holes or indentations you want.

What use is that?

"Take color television," says Dr. Condon. "In the TV tube, the light has to pass through holes exactly placed in a screen, and strike a pattern of colored phosphor beads. We could make that screen by 'chemical machining.' Photographic glass has a great future. Like so many of our products, it grew out of industrial research.

"We would like to do more of this long-range research. And we could, if we could only get more trained people. There's a great shortage of technically trained people."

The glass industry, like nearly all industries, is hunting for workers with technical ability. This means not only scientists, but men with many other kinds of precision skills. Corning, for instance, needs hundreds of technically skilled people for the precision jobs of mixing and melting glass, of shaping and cooling it, of making tools and machines for handling the glass.

The Old Art of Glassblowing

Developing ways and equipment for factory production of a new glass product is often just as big a research job as inventing the new glass in the first place.

The old way of glassmaking is the hand way. It's still the most economical way to fill a small order or to make a specially-shaped kind of ware. You can see this fascinating process in some of Corning's factories.

The "gatherer" stabs the heart of a fiery furnace with a hollow metal rod. Out comes a white-hot glowing glob of glass. The gatherer swings it like a shooting star. The "gaffer"—the master blower—takes over and blows through the tube. Slowly he breathes form and shape into the taffy-like glob.

Up to 50 years ago there was no substitute for the gaffer's lungs in shaping glass. But in 1903 Michael J. Owens, an Ohio glassmaker, perfected a machine that did what every glassblower said was impossible. It blew bottles by compressed air.

The machine age had caught up with the glass industry at last! Today machines can make almost any kind of glass except fine art crystal. At its Wellsboro, Pa., factory, Corning Glass Works has a machine that blows electric light bulbs—a thousand per minute!

We talked to one young man who has found a career making the tools and machines of the glassmaker's trade. He is 24-year-old Curtis Neuner. He had just finished his four years as an apprentice in the machine shop.

"The apprenticeship program was my big opportunity," Neuner told me.

"From the time I was 13, I worked summers in a machine shop. I had my own little shop at home. The reason I signed up to work at Corning Glass was that I was promised a chance to be an apprentice—and become a skilled machinist-toolmaker.

One Man's Apprenticeship

"I worked in the machine shop for about a year before an opening came as an apprentice. To get into the program, you have to have a high school educa-

(Continued on page 33)

GLASS FOR BUILDING: Twenty miles of glass tubing form the walls of the new S. C. Johnson & Son research center at Racine, Wisconsin.

GLASS FOR SCIENCE: With oxygen torch to melt glass for sealing complicated parts, a "lampworker" puts finishing touches on hand-fabricated glass pump.

INTERVIEW OF THE WEEK

Science Makes Your Future

J. R. Killian, Jr.

Shake Hands with Dr. James Rhyne Killian, Jr.
President of the Massachusetts Institute of Technology

By KENNETH M. GOULD

"FIFTY years ago America had only one engineer for every 250 employed workers of all kinds. Today, in 1953, there is one engineer for every 60 other workers. And we have by no means reached the end of this trail."

The words came from a friendly, easy-to-talk-with, solidly built six-footer. He looked as if he might be just as much at home in a checkered shirt around a hunter's campfire—and in his spare moments he is. This is Dr. James R. Killian Jr., the young (48-year-old) president of Massachusetts Institute of Technology, at Cambridge, Mass., probably the most important school for technical training in this country.

We were sitting in Dr. Killian's big, sunny, modern office in the central bloc of domed and pillared buildings facing the Charles River Basin, which constitute the heart of this great "university of the sciences." When you enter this fabulous place, the doors swing open before you by the magic of selenium (photoelectric cells). Push a button, and lights flash on a huge colored map to show you where to go. If you explore further on the crowded 100-acre campus, you will find yourself in some of seventy special laboratories. There world-famous scientists and their lucky students are constantly asking themselves the questions, "How does it work?" and "Why does it happen?"

Brains—Mechanical and Human

They are laboratories that house some of the rarest and most expensive equipment in the world. Here are the "whirlwind computer" and other giant mechanical brains built by M.I.T., the cyclotron, or the high-voltage generators for electrical engineering. You can visit the Wright Brothers Memorial Wind Tunnel and the Supersonic Laboratory, the Nuclear Science (Atomic Energy) and Electronics Research Laboratories, where radar was invented.

Each scientific field, said Dr. Killian, tends to follow an S-shaped curve in its growth. The number of engineers, now about 400,000, has been doubling every twenty years. The 100,000 chemists double every fifteen years. Physics is a younger science; it has only 20,000 physicists, who double every eight years. It has been having a rapid growth since World War II, due partly to the atomic energy field, but even more to the jump in electronics and optics.

American industry, entirely apart from the defense crisis, now needs from 30,000 to 40,000 *new* engineers every year. It is not getting them, because enrollment in engineering schools fell off badly a few years ago. For some reason, the notion got around that engineering is a crowded field, and high school students have sometimes been wrongly advised not to enter it. But all signs point to an even greater shortage of trained engineers, chemists, and physicists from 1955 to 1960. And incidentally, these fields are by no means closed to girls! The number of women in chemistry and the biological sciences is growing rapidly.

"Why should young people be interested in science these days, anyway?" we asked Dr. Killian. "Haven't we had enough technical progress—too much, maybe, when we think of what a hydrogen bomb can do?"

"That's a tough question, all right," smiled M.I.T.'s prexy, "but I think I can answer it. I'll admit we live in a grim and uncertain world, and science doesn't have all the answers. Perhaps we expect too much of it. But I'm an optimist about the future of the human race. Science is not limited just to making destructive weapons. It has limitless frontiers of improvement in social welfare and human relations. The universities and foundations are spending great sums today on research in the fields of psychology and communications. We are studying how people and nations can get to know and understand each other better.

Science Has a Job for You

"Four hundred years ago a few far-seeing men like Lord Bacon began to think about 'the invention of invention.' They started a process which swelled into a flood in the nineteenth and twentieth centuries. Through this process the experimental findings of men in the scientific laboratories can be applied by other men in the shops and factories to the making of a thousand things for the comfort, health, and happiness of mankind. They gave us the foundation on which modern industry has built the highest standard of living in the world for the most people.

"We cannot stop there. If we want to go on creating a humane, intelligent world in which all the millions of human beings can enjoy the good things of life, more and more people must understand the scientific process. More and more able and ambitious young men and women must choose science for their careers."

"How about you, Dr. Killian?" we asked. "When you went to high school in Georgia, and to Duke University in North Carolina, did you have a clear idea of your goal in the technical sciences?"

"No indeed," he admitted cheerfully, "I'm afraid I'm a

(Continued on page 33)

RESEARCH

Builder of America

Builder of jobs

Builder of tomorrow

All over America, research is stepping up its pace. To those engaged in it, it is the most exciting work in the world. Each knows that the little light he sees today may be a star in tomorrow's sky.

It begins quietly with a scientist in his laboratory . . . a technician at his bench. Few hear of what they are doing as they plug away.

Then, suddenly, there comes an invention that changes a way of living . . . that creates new industries and new careers . . . that binds this country together even as it helps it grow.

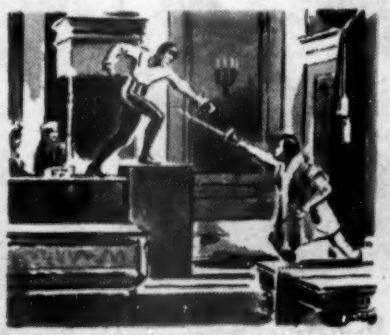
Many of these developments have come out of telephone research. Today, in 90 seconds on the average, you can reach any telephone in 70,000 communities in America. Did this just happen? What things had to be discovered first?

You'll find quick, exciting answers to these questions in this picture story.

Is this a rocket to the moon?

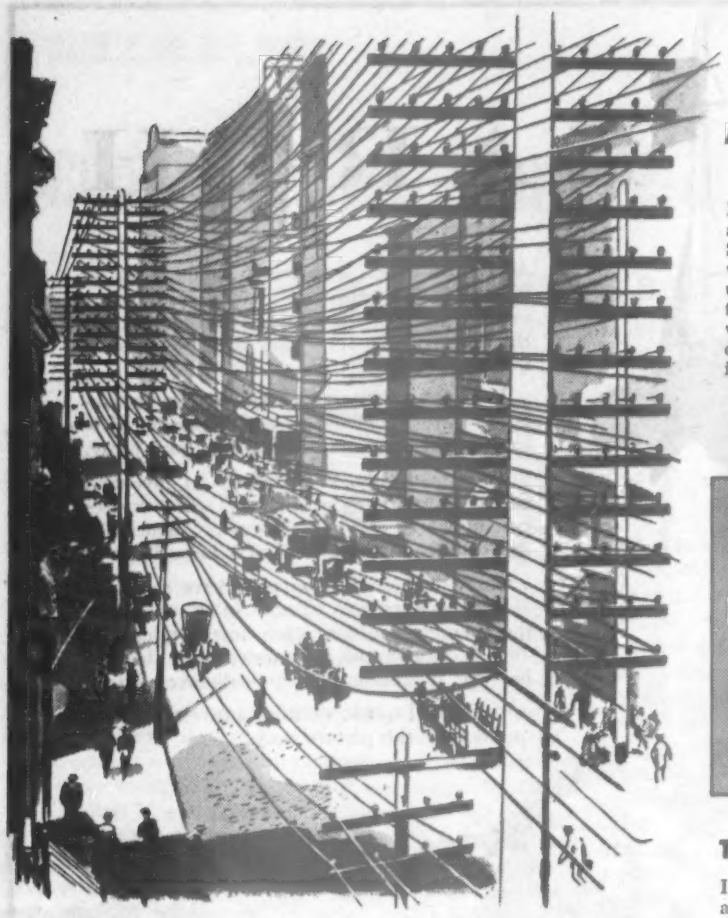
No – it's one of America's anti-aircraft guided missiles taking off. Launched, steered and exploded by electronic controls, the missile blasts into enemy aircraft at supersonic speed. This is one of the most dramatic products of American research. The electronic devices that launch and control the missile were produced by telephone scientists working with the Douglas Aircraft Company, which developed the missile itself. Bell Telephone men had been working with electronics for telephone purposes. When the country called on them in an emergency, they put their knowledge to defense use.

Is he talking by wire, air or pipe? The telephone company will speed his voice home to Mother by any or all of these channels, when he uses *today's* telephone. Long Distance calls may go part of the way by wire or cable . . . leap into the air over the new Radio-Relay microwave system . . . or use the small pipes in a coaxial cable. (Radio-Relay and coaxial are described on the following pages.)



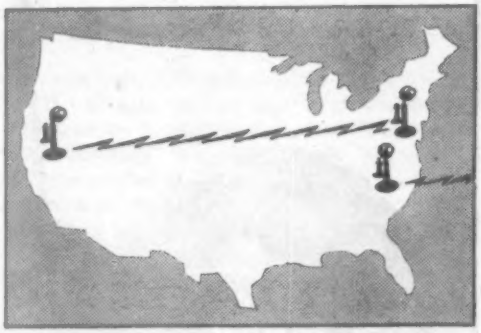
Did movies always talk? No, the old timers were silent. Then Bell System scientists developed the equipment that made sound movies practical. In the picture illustrated above—John Barrymore in *Don Juan* – music was first synchronized with action on film. That was in 1928. A year later came the first full-length movie with speech—Al Jolson in *The Jazz Singer*.

How does a television show reach your home? It travels over the telephone system part of the way. In fact, in a coast-to-coast network broadcast, both television and radio use special telephone lines 99% of the way from studio or stadium to you. The same research that led to modern telephone service provided channels for our great entertainment and information networks.



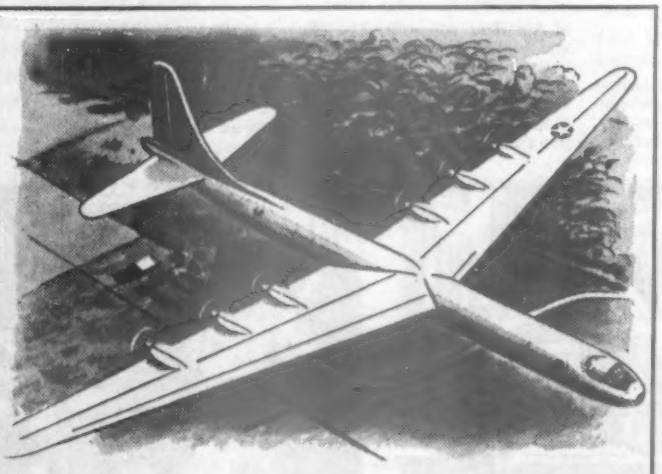
Ask Granddad
If he remembers this

It's Broadway, New York City, in the 1880's—shortly after Alexander Graham Bell invented the telephone. So many people wanted telephones that there simply wasn't room for all the wires. Could they be buried underground, in cables? No, said some; voices couldn't travel that way. But Bell System research came up with a new kind of cable. It replaced many thousands of miles of overhead wires . . . made it possible to interconnect millions of telephones.



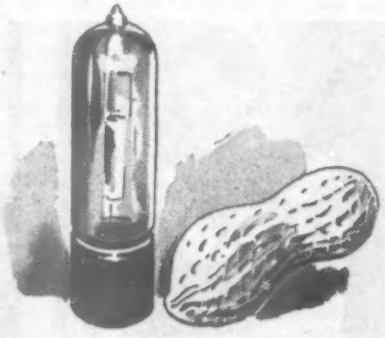
Talking across America

It happened for the first time in 1915 — three years after research men at Bell Telephone Laboratories developed the first practical amplifying vacuum tube. Tubes in "repeater stations" boosted voices as they sped from New York to San Francisco with the speed of light. Other tubes helped send conversations across the Atlantic for the first time, from Arlington, Va., to Paris. Thus, research linked Americans together—and with the world overseas.



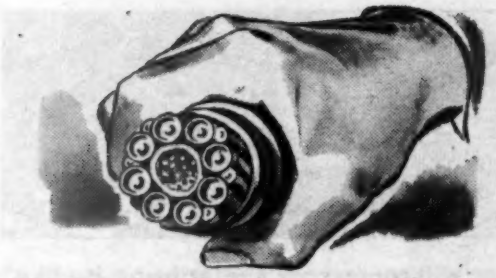
Research pays off for the U.S.A.

Radar bombing systems for America's airplanes are important examples of the way research helps the country in emergency as well as in peace. The research branch of the telephone system alone is working on more than 100 defense assignments. They include atomic weapon developments and other top secret work. Bell scientists have already produced fire control equipment for anti-aircraft guns, improved radar, and a new field telephone for the Army.



"No bigger than a peanut"

That's what they said when the vacuum tube shown above was produced. (Scientists still speak of it as the "peanut tube.") Because it saved space and drew less current, it could be much more widely used. One of the main jobs of research is often to make things smaller, handier and less expensive, as well as better.

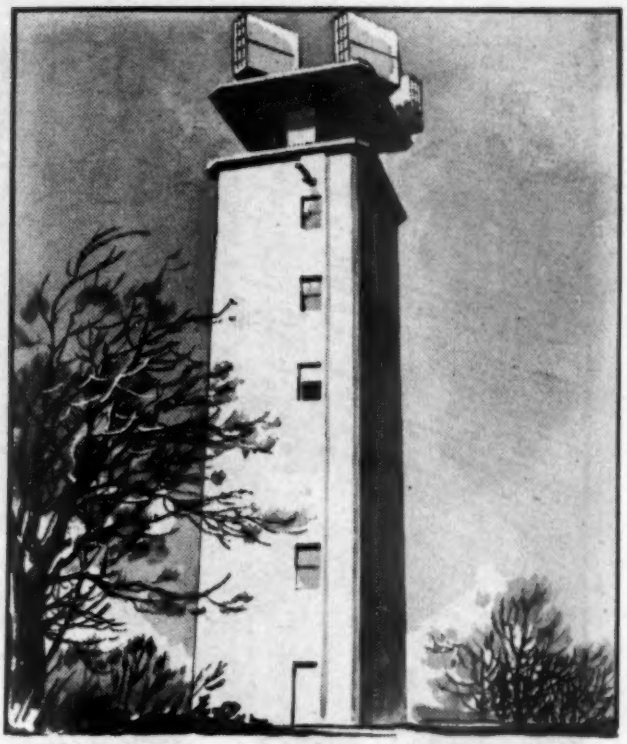


1800 at a time

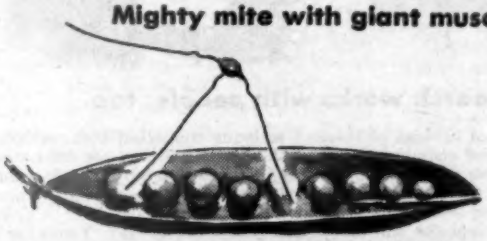
Once, only one conversation could travel over a pair of telephone wires. But more and more Americans wanted to talk. So "carrier telephony" came into being—using currents of different frequencies to carry several telephone messages on a single pair of wires. Then, in 1929, Bell scientists invented the famous coaxial cable, shown above. In coaxial, electrical voice vibrations travel through narrow pipes buried in the earth. Each coaxial pipe can carry as many as 1800 telephone voices at once—or 600 voices *plus* a good, clear television program.

A voice highway through the air

Coaxial gave the nation another communications link, but research men looked ahead and saw that still more channels would be needed. In 1947 they introduced Radio-Relay transmission of telephone voices and television. In Radio-Relay, metal lenses focus radio microwaves as a glass lens focuses light rays. Voices and network television ride the beams across the country. Because microwave beams won't bend and follow the earth's curve, Radio-Relay lenses must be mounted on towers or in stations high in the mountains. Then the messages are relayed from one to the other. It takes 107 stations to span America from the East to West Coasts.



Mighty mite with giant muscles



Here is one of the latest products of research in America. It is called a ***Transistor*** and was invented by the Bell Telephone Laboratories. No bigger than a pea, the ***Transistor*** can do many things a vacuum tube can do—and more. For example, it can amplify voices 100,000 times, using only a *millionth* of the power of the smallest tube. The ***Transistor*** has no glass, no vacuum, no filament. It consists of a wafer of a metal called ***germanium***, connected to three hair-thin wires. ***Transistors*** may revolutionize the whole world of electronics—in television and radio sets . . . "electronic brain" computing machines . . . radar and secret defense equipment.

"Hello . . . I'm calling from the car!"

This mobile telephone, mounted right in an automobile, is one of many that have been produced by the Bell Telephone System for special uses. Other special installations let us talk from trains, airplanes, and ships far out at sea.

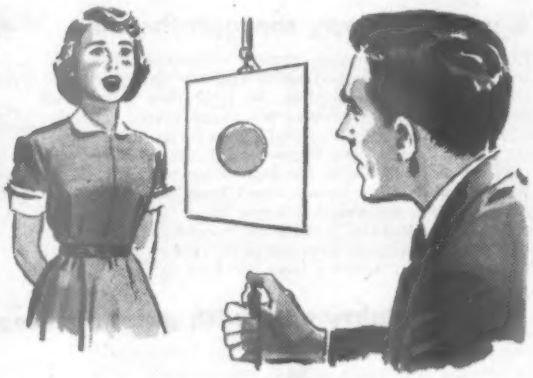
TURN PAGE
FOR MORE ABOUT RESEARCH

It almost thinks for you!

You've heard a lot about "electronic thinking machines." Here's one of them—an automatic telephone switching mechanism which goes to work when you dial a number. It takes the number you want, remembers it, finds the fastest way to get it, and even seeks an alternate route if one is busy—all in a matter of seconds.

What will tomorrow's telephone be like?

Here's just one indication. The fingers of that Long Distance operator are "dialing" a number—perhaps thousands of miles away. Some day every telephone subscriber may be able to reach any telephone in the country simply by dialing a number. Right now, 10,000 subscribers in Englewood, N. J., are making daily use of the first customer Long Distance dialing equipment. Still another future possibility is that you may some day just speak a number into the telephone and get the person you want automatically. And telephony is just *one* field where American research is working to make things easier and faster for all of us.



Research works with *people*, too

Most of us think of research as being connected with mechanical and chemical things. But today's scientists are interested in those things particularly as they relate to what *people* want. Then they set about to provide it. Here, a young girl's voice is being tested—one of a long series of studies designed to make the telephone still easier and pleasanter to use. Tomorrow's telephone will be built around things that people want. So will all the other advances science is getting ready for America even now.

What does this mean to you as you think of your future?

In the telephone business there are many different kinds of careers. Few businesses today offer such chances for varied and satisfying work in a public service, linking together the lives and activities of people, as the Bell System does. In each day's operations, telephone companies need men and women of various educational backgrounds and skills—craftsmen, operators, engineers, typists, clerks, scientists, sales and contact representatives, outdoor and indoor workers.

Each job opens the door to a fine future, with a high degree of job stability and security. There are many chances for promotion, in an interesting and constructive field that means much to our country. If you would be interested in finding out more about these opportunities, ask your school guidance counselor or inquire at your own telephone company office.

BELL TELEPHONE SYSTEM

Science Makes Your Future

(Continued from page 28)

poor example of what I preach. Down South I played in the school band, debated, and joined the track squad. When I got a scholarship to Duke, I thought I was going into the textile business, like my father. But I had a chance to transfer to M.I.T., and I've been here ever since.

"I'm not a specialist in any one scientific field. But I got mixed up in journalism, became managing editor of *The Technology Review*, the alumni magazine, and from there was asked to become executive assistant to the president, Dr. Karl T. Compton."

Perhaps we'd better spare Dr. Killian's modesty the rest of the way. When Dr. Compton, the distinguished physicist, was called to Washington for essential work in defense research during World II, he chose Jim Killian, then only 39 years old, to be executive vice-president of M.I.T. Five years later, in 1948, Killian was recommended by Compton to succeed him as president. So Dr. Killian came into technology through the back door of technical journalism and administration.

"When you talk about Big Business these days," explained Dr. Killian, "you really mean Big Technology. The men who run our great corporations are increasingly finding it essential to have technical training. Look at Fairless of U. S. Steel, Sloan and Wilson of General Motors (now Secretary of Defense), Greenewalt of Du Pont, Craig of American Telephone, Abrams of Standard Oil of New Jersey, and Wilson of Standard Oil of Indiana. All of them are engineering or science graduates, and we are proud that some of them came from M. I. T.

"America spends three billion dollars a year on scientific research—$20 for every man, woman, and child in the country. More than half of this—about 55 per cent—is paid for by the Government today. That's because of our enormous stake in defense industry and atomic energy. Of the rest, 40 per cent is supported by private industry, and only 5 per cent by universities and other non-profit institutions.

"But, as defense spending tapers off in the next few years, I confidently expect the percentage of private industry's support of research to rise to where it was ten years ago. Business has the greatest need for basic scientific knowledge, because it cannot successfully compete without it.

"So, to any young person—boy or girl—who looks forward to a life of both service and prestige, I sincerely say: 'Look to science. It will make your future.'"

This glass will become thermometers. Gaffer (left) slowly backs up, blowing to keep bore open inside the hot, taffy-like glass. Man in center checks diameter.

Glass Houses

(Continued from page 27)

tion, or the equivalent. You have to have a good record on the job. You have to pass aptitude tests, too.

"During my four years I put in over 8,000 hours' work in the machine shop. I got a chance to work in all parts of the shop. I also went to classes four hours a week. I studied mathematics, metallurgy, physics, economics, and other subjects that helped prepare me for a career at Corning."

At his "graduation" as an apprentice, Neuner received a state certificate showing that he was now a "journeyman." This rating indicated that he is a skilled toolmaker-machinist. It meant an automatic rise in pay.

And if he does a good job in the next couple of years, he will be considered for advanced training in designing of tools and machinery. This training will give him the rating of junior design engineer. He'll have a chance to move on to a supervisor's job.

There are other avenues to opportunity in the glass industry. Glass factories need many young people for beginners' jobs.

The boy just out of high school usually starts as a helper on a job where he is paid by the hour. He can work into more skilled jobs, such as operating a machine or a glass melting tank. One way he can get ahead to more responsible positions is to sign up for the "general training" program. Those who pass the necessary tests and interviews are admitted to evening classes on their own time. They study the company's organization and products and the problems of supervising others. From "general training" graduates, CGW picks many of its men for supervisory positions.

For girls, there are clerical and stenographic jobs. Business training teachers in the local high schools visit Corning Glass Works to learn what kinds of jobs are opening up. On Saturdays, when CGW's business departments aren't working, business classes get a chance to come to the factory to look over and operate the various business machines.

If you are aiming at a scientific job, of course, you'll need additional training beyond high school. CGW hires dozens of college-trained people every year for technical and administrative jobs.

Arthur Brintnall, assistant director of industrial relations, says:

"In picking people for specialized jobs we give about equal weight to these three factors: 1, scholarship; 2, aptitude, as shown by tests which we give; and 3, our judgment of a person's possibilities as a leader. We judge this on the basis of interviews and of his record in school. We believe that the best indication of a man's leadership later in life is what he's done up to the time we see him.

"The course a student takes in high school isn't terribly important to us. We believe we can give him the specialized training on the job. We're more interested in the kind of record he makes—in whatever course he takes—and the leadership he shows and the way he works with people."

Storm Warnings to the South

A look at Latin America's troubles

MEET "Mr. Latin America"!

He's a hard worker, but he's desperately poor. He earns a few cents a day on a farm, or in a mine, or in a factory. He lives in a hut. He's often hungry and sick. He yearns for a better life.

He's a *peon*—your Latin American neighbor. Peon is the Spanish word for "laborer." There are millions of peons in Latin America. They outnumber landowners, businessmen, "white collar" workers, and all other types of Latin Americans put together.

The peon is Latin America's backbone. His sons are the soldiers for the army. He and his family produce the raw materials that are Latin America's chief riches. He mans the machines in the factories. He votes, too, in most countries—and recently he has been joining labor unions that are clamoring for a say in what goes on.

Politicians win the peon's support by promising him reforms: a farm of his own, higher wages, better working conditions, a healthier, happier life.

If the politician finds he can't "deliver" on his promises, he often tries to blame someone else—often Uncle Sam.

"It's the Yankees' fault," the politicians say. "When they buy our goods, they don't give a fair price. The companies Yankees run in our countries are swindling us out of our natural resources. The Yankees spend billions on aid to Europe and Asia—and only a few millions in helping us, their closest neighbors."

Uncle Sam sincerely wants to be a good friend and good neighbor. He's worried about the anti-U. S. storms brewing recently in several countries "south of the border."

1.—GUATEMALA

Uncle Sam is interested in Guatemala mostly for its bananas and coffee—and because of the threat of a Communist base in our back yard. Guatemala, where the Reds seem to be getting a foothold, is within 800 miles of the U. S., within 800 miles of the Panama Canal.

Communists are busily at work all through Latin America. The poor, uneducated peon often listens with interest when Communists promise him a better world. Yet, in most Latin American countries, the Communists haven't made much progress. They face the combined opposition of the Roman Catholic Church (to which most Latin Americans belong) and of the conservative, landowning groups that usually control the army and the government. Fifteen of the 20 Latin American countries have outlawed the Communist party.

But in Guatemala, Communists operate openly. They have gotten control of the labor unions. Some Communists have important jobs on newspapers and in the government's radio stations.

Only four known Communists sit in the 54-man Guatemalan Congress. President Jacobo Arbenz Guzman (an army officer) and his cabinet members deny they're Communists. But they have been accused of welcoming Communist backing and cooperating with the Communists.

One project on which the Guatemalan government and the Reds work hand-in-glove is "land reform."

About 70 per cent of the land in Guatemala is owned by only two per cent of the people. Last year the Guatemalan Congress passed a law giving the government power to take over unused farm land and divide it among peons who have no land.

One target of the law was an American-owned company. Last month Guatemala announced that it would take away 225,000 acres of land owned by United Fruit Company. This U. S. firm grows bananas in various Central American countries and ships them to the U. S.

Company officials protested: "All but 20 per cent of our land is in use. Therefore the land reform law doesn't apply to us. So why take away three fourths of our land? We've invested $60,000,000 in the banana-growing business here. We're the biggest employer in Guatemala—and the 11,000 Guatemalans who work for us make more than they could earn in most other jobs. If you go through with this, we may have to close up shop and quit operations in Guatemala altogether."

2.—BOLIVIA

The main reason Uncle Sam is interested in Bolivia is tin.

We get most of our tin—one of the most important metals for industry—from southeast Asia. But if we should be cut off from Asia by a war, we would depend on Bolivia for much of our supply.

Throughout its 128-year history, Bolivia has had a revolution on the average of about every two years. No elected president ever served out his term. The government has changed hands oftener than in any other Latin American country.

Last spring Bolivian peons rose in revolt and threw out an army group that had seized the government the year before. The new president who was swept into power is Victor Paz Estenssoro. Last fall he signed an order putting Bolivia's biggest tin mines under the ownership of the Bolivian government. Americans had a $7,000,000 investment in the nationalized mines.

In protest, the U. S. Government stopped buying tin. (Private U. S. concerns are not allowed to import tin to the U. S.) In January the U. S. and Bolivia signed an agreement to get the tin trade started again. Bolivia promised to pay the former owners of the tin mines for their losses when the mines were nationalized.

But Bolivia is now talking of paying only a third of the $60,000,000 which the former owners claim as the value of the mines. The U. S., so far, has bought only one small batch of Bolivian tin.

Recently Bolivia made a deal to sell half her tin output to Britain for the next three years. Bolivia wants the U. S. to buy the other half.

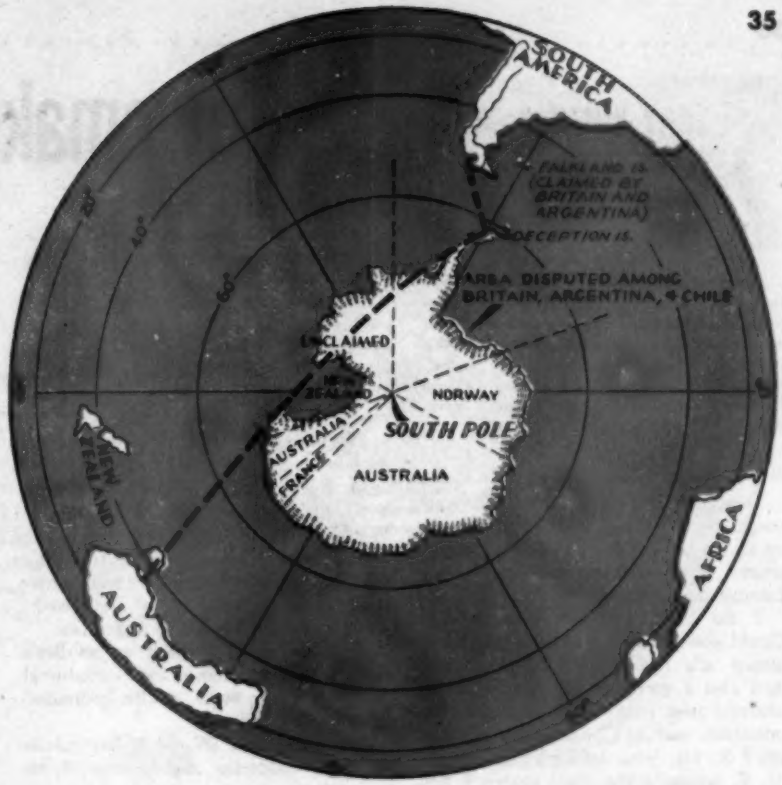
If she doesn't get her tin industry going again, Bolivia is in for more trouble. When income from tin—Bolivia's chief wealth—goes down, discontent goes up. Right now, bands of peons armed with pickaxes and sticks are surging through the countryside, demanding land reforms.

3.—ARGENTINA

Uncle Sam is interested in Argentina because it's one of the richest and most powerful Latin American countries—and it's our chief rival for leadership in the Americas. Argentina has seldom been more "anti-Yanqui" than it is right now. And Argentina's boss, Juan Peron, has been helping his friends—such as Paz of Bolivia, Jose Velasco Ibarra of Ecuador, and Carlos Ibanez of Chile—come to power in other South American countries. Paraguay has long been under Peron's thumb.

Is Peron trying to build an alliance of his friends? On his recent visit to

OUR AMERICAN NEIGHBORS



Maps at right

Upper map: **Now that "over-the-North-Pole" aviation is an everyday affair, "over-the-South-Pole" air routes are under study. Heavy broken line shows probable route of airline Chile plans from the southern tip of South America to Australia. As a first step, Chile wants to build an airfield on Deception Island, in the South Shetlands, about four hours' flying time from Chile. Britain already has a landing field there. Last month the British chased two Argentines off the island and demolished buildings set up near the airfield by Chile and Argentina. All three nations claim the area.** ***(See WW, Mar. 4, p. 6.).*** **The map shows how various nations claim "pie-cut" slices of the frozen continent of Antarctica.**
Lower map: **The Latin American mainland—and some of its trouble spots.**

Chile *(WW, Mar. 4, p. 2)*, Peron and Ibanez signed a treaty aimed at increasing trade between Chile and Argentina. Some observers say this is just the first step toward a close union of Chile and Argentina—with other neighboring nations to be brought in later.

4.—CHILE

Uncle Sam is interested in Chile for its minerals—especially copper.

When Ibanez was running for president of Chile last year, a lot of "anti-Yanqui" feeling was stirred up. Some reports said he aimed to nationalize Chile's copper industry and to throw out the agreement under which the U. S. supplies military aid to Chile.

After the election, Ibanez said he wanted to be friends with the U. S.

(Many a Latin American politician, after getting into office on an anti-U. S. program, changes his mind and "plays ball" with Uncle Sam.)

LATIN AMERICA AND US

Why is Uncle Sam so interested in what happens in Latin America?

The Latin Americans are our allies in the Rio pact. That treaty pledges all the American republics to work together to defend our hemisphere against any aggressor.

Latin America is Uncle Sam's chief partner in world trade. We get a third of all our imports from Latin America.

Americans have about $5,000,000,000 invested in Latin American enterprises (chiefly Venezuelan oil).

Uncle Sam is trying to help the peon to a better life. Under our aid program, for which we spent $20,000,000 in Latin America last year, our Government sends experts to help Latin Americans improve farming, health, and schools.

"Saludos, amigos!" says Uncle Sam to the peons of Latin America.

. . . and that's what we mean! This letters column, a regular feature, is open to opinion on any subject and criticism of any kind, brickbats or orchids. We want to know *what's on your mind.* Other readers do, too. Address Letters Editor, *World Week*, 351 Fourth Ave., New York 10, N. Y.—*The Editors.*

Dear Editor:

One good reason why I like your magazine is because you include a page on stamp news. I am a collector, and of course your articles on new issues interest me greatly.

I do have a suggestion, though. Could you possibly include some more stamp ads from different companies, and also a picture and description of unusual new issues from some foreign countries, such as China, Japan, France, etc.? So far, your information on new U. S. issues is the only source I can find here at school.

Keep up the good work on stamp news.

John B. Lindsay
Church Farm School
Glen Loch, Pa.

Our stamp editor says: "First, we cover all U. S. issues, and next, new United Nations issues. We also include as many new foreign issues as we can get while they're still *new*. We have written to every foreign country with a postal department to put us on their mailing list but only a few of them send us material promptly. When we can't get a copy of the stamp to reproduce, we often describe it in a paragraph."
—*Ed.*

Dear Editor:

In your Feb. 18 issue, you printed an article about the magazine *Latinitas*. Could you tell me how to get a subscription?

Virginia Stritzel
Webster, N. Y.

We suggest that you write to Msgr. Antonio Bacci, Vatican Library, Vatican City, Rome, Italy.—*Ed.*

Dear Editor:

I was most disappointed to see your Movie Check List. My friends and I thought that almost all of the pictures were in the wrong place. The pictures that we thought were *good* you had under "Fair" or "Save Your Money." And the pictures that were *terrible*, you had under "Tops." They did not deserve it.

Charles Skeete
Riverhead, N. Y.

Dear Editor:

I enjoy *World Week* very much, since it gives me a chance to catch up on the week's news and sports, because I do not have time to read the newspapers during the week.

In the news test at the end of each issue, why don't you put the answers on another page in the magazine? Sometimes I have had a hard time finding the correct answers in the articles.

M. Kerrigan
McBurney School
New York, N. Y.

Workbook answers appear in the Teacher Edition, so you can check your answers with your teacher. We do not include the answers in the magazine because many classes use the Workbook as a class quiz.—*Ed.*

Dear Editor:

I have heard several students in my school discussing the Movie Check List, and everyone disagrees with it. I second the motion to remove the Movie Check List from *World Week* and put in something that will be enjoyed by all readers.

Janice Thornton
South Jr. H. S.
Abilene, Texas

Dear Editor:

I enjoy *World Week* very much, but if you would print more poems, I think students would pay more attention.

Carol Jackson
Wyandotte H. S.
Kansas City, Kans.

Newsmaker

Wide World photo
Aristotle Onassis

GREEK WHALE HUNTER

German shipmakers are fitting out a strange ship for an unusual man with a fascinating name.

The ship is a private yacht with an ice-breaker prow. It is being built on the hull of a one-time U. S. war vessel, the frigate *Stormont*. It will have fittings for launching an amphibious plane and a super-speedboat.

The man is Aristotle Socrates Onassis. As you might guess from his name, he is—or rather was—a Greek. His family lived in what is now Turkey. After World War I the Turks drove the Greeks out of Turkey. Half of Aristotle's family were killed. At 16 he was homeless, penniless, stateless—a "man without a country." He fled to Argentina.

From a start pushing a peddler's cart, he rose to become an international business figure with wealth estimated at $300,000,000.

He owns over 90 ships, has homes in four countries and offices in six countries.

Two years ago he decided to open an office in a seventh country, little Monaco, on the Mediterranean between France and Italy. He tried to rent an unused sports club. The owners refused. That didn't stop him!

Recently he announced that he had control of the building at last. To do it, he had patiently bought up the stock of some 2,000 owners of the corporation that owned, among other things, the sports club. And in the bargain, he had gotten control of several hotels, sports clubs, and the world-famous Monte Carlo gambling casino.

"I never gamble. It doesn't amuse me," he told an interviewer.

He prefers gambling on a world-wide scale. His biggest gambles are his Arctic whaling expeditions.

"Poor old Moby Dick!" said Mr. Onassis. "In those days a whaler would be gone two or three years and had to go through horrors. Today my whaling fleet has a 'mother ship,' 16 chasers, two tankers to supply fuel, a helicopter to spot the whales, radar, a hospital, dentist, swimming pool, and movie."

It's expected that the yacht under construction will be an inspection ship for his whaling fleet.

OUR FRONT COVER: The man in our cover picture works for Chrysler Corporation. Maybe you wonder why an automobile company needs a laboratory like this. Maybe you'll wonder all the more when we tell you what this research scientist is doing. He's running molecules through a glass maze and counting how many of them stick on the surface of fine powders. But there's a reason! This research helps Chrysler figure out how to paint cars so the paint really sticks—how to seal parts more tightly with rubber cement—how to lubricate a car so that the lubricant clings to the surfaces of the bearings. It's just another job for INDUSTRIAL RESEARCH (*see pages 9-33*). —*Chrysler Corporation photo.*

HAVE YOU HEARD?

DON'T THROW YOUR FUZZY OLD RECORDS AWAY!

Those scratchy records, too bad to play, too hot to toss out, can be made to sound "young" again. You disc fans will be happy to know General Electric engineers have come up with a new Record Compensator that helps cut the surface noise from old 78 rpm shellac records. The device has a five-position variable control for "hi-fi" tones.

TWO PICTURES ON ONE TV SCREEN

TV viewer's dream comes true: how to follow the action in two places at one time. New G-E portable pickup system does jobs formerly almost impossible except in the studio. Look for electronically controlled split pictures on your set this season!

SOUNDLESS SOUND LAUNDERS GREASY OBJECTS

Soaking greasy parts in liquid solvent to de-gunk them is done in lots of factories, but G-E engineers hit on an improvement. Sound waves—too high to hear—now speed the job of the solvent. Laboratory engineering in the field of *ultrasonics* is making new gains for industry.

You can put your confidence in—

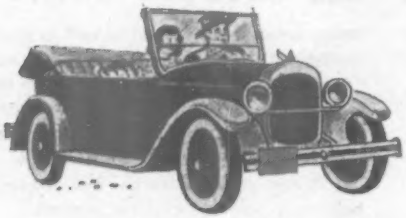
GENERAL ELECTRIC

GREAT MOMENTS

IN THE HISTORY OF CHRYSLER-BUILT CARS

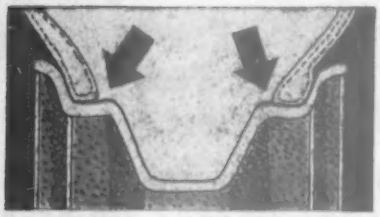
1923 ALL-STEEL BODIES

The first all-steel safety bodies for enclosed passenger cars heralded a radical departure in automobile body building. With the first all-steel bodies introduced by the Dodge Division, wood body parts including those previously used for structural reinforcement were eliminated altogether. Despite the skepticism of the rest of the industry, customers soon discovered that the new all-steel bodies were safer and stronger in every way, were finer in appearance and easier to maintain. The enthusiasm of the driving public for these significant advantages eventually forced the entire industry to follow.



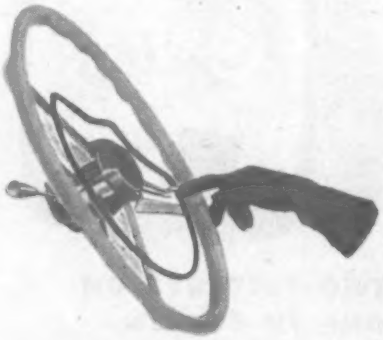
1924 FOUR-WHEEL HYDRAULIC BRAKES

Walter P. Chrysler and his engineers realized that stopping power had not kept pace with going power in the still young automobile industry. The introduction of four-wheel hydraulic brakes for passenger cars, like many other automotive developments of the time, was an engineering gamble. But it was a gamble that paid off to become one of the basic advancements in automobile progress. Customers quickly recognized the increased safety value of this remarkable means of bringing the car to a swift, sure stop. They wanted it, and four-wheel hydraulic brakes became universal on American automobiles.



1940 SAFETY-RIM WHEELS

Particularly noteworthy among the many advancements in driving safety introduced by Chrysler Corporation are Safety-Rim Wheels, which made their first appearance in 1940 and have equipped all Chrysler-built cars since. Developed for protection in case of a blowout, Safety-Rim Wheels have special retaining humps designed into the inner rims to hold a deflated tire and tube on the wheel until the car can be brought to a safer, straighter, controlled stop. Safety-Rim Wheels are just one of the long list of safety "firsts" by Chrysler, engineered for greater protection of the driver and passengers.



1951 POWER STEERING

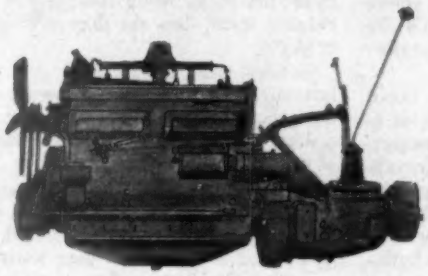
Power steering, offered first by Chrysler in 1951, established entirely new standards of automobile driving ease, comfort and safety. Engineered to perform 80 per cent of the steering work automatically, this revolutionary full-time power steering mechanism instantly supplies hydraulic power assistance during all driving and parking conditions whenever the steering wheel is turned. Full-time Chrysler Power Steering reduces driver fatigue during turning and parking, makes ordinary "straight ahead" driving easier and safer by resisting ruts and chuck holes, and provides quicker, surer control on wet or icy roads.

CHRYSLER

The story behind some of the famous "firsts" in automobile progress—

part of the long and growing list of advancements pioneered by Chrysler Corporation.

The first Chrysler "Six" of 1924 was a spontaneous sensation as a newcomer in an already crowded field. Willing to stake their future on a belief they could produce a better automobile, Walter Chrysler and his associates completely engineered the first Chrysler from start to finish. Over the years, Chrysler Corporation has steadily advanced its reputation for engineering good things first. Today, a staff of more than 3000 engineers is constantly adding to this growing parade of outstanding new developments in the automobile industry.

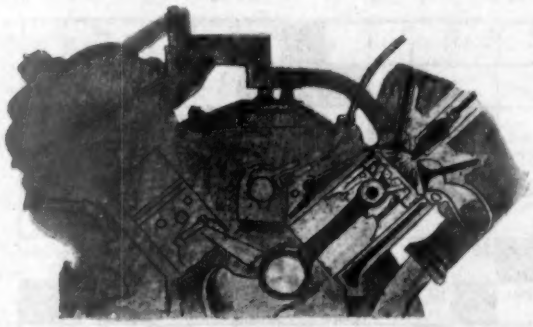


1928 HIGH COMPRESSION ENGINE

Chrysler engineers introduced the first modern high compression automobile engine in 1928 and called it the Chrysler "Red Head." From a standard compression ratio of only 4.6-to-1, the Red Head stepped up to 6.2-to-1, making possible more effective use of improved higher-octane gasolines, and producing greater engine efficiency and more economical performance than had ever been known. The 6.2-to-1 ratio pioneered by Chrysler Corporation in the Red Head was so far advanced in its day that it was not for ten years afterward that the rest of the industry was able to make it a standard.

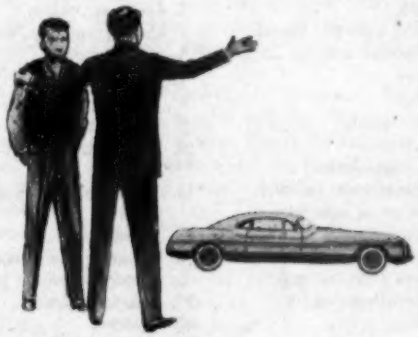
1931 FLOATING POWER ENGINE MOUNTINGS

Greater driving comfort, as well as increased safety and performance, was a constant aim of Chrysler engineers in the early days, just as it is today. Climaxing years of research, Chrysler was able to introduce in 1931 an advanced method of supporting the automobile engine in perfect balance on rubber mountings bonded to steel. Now vibration impulses originating in the engine could not be transmitted through the body of the car by metal-to-metal contact. This development, called "Floating Power," had far-reaching effect in reducing driving fatigue and increasing the comfortable ride of Chrysler Corporation cars.



1951 HEMISPHERICAL COMBUSTION CHAMBER ENGINES

Increased effectiveness of the modern automobile depends more on increased efficiency than on higher speeds. Toward this end, Chrysler engineers developed and perfected an advanced designed automobile engine with the famous Hemispherical Combustion Chamber. Formerly used only on aircraft engines and in a few racing and sport cars, this engine design was adapted by Chrysler engineers for the first time to quantity production for passenger cars. Designed to deliver far greater efficiency on either regular or premium fuel, the hemispherical head engine is probably the most spectacular of all the Chrysler engineering "firsts."



WHAT NEXT?

Chrysler engineering does not stop here, but works on in ever-expanding fields, improving the fine cars of today and searching for other remarkable developments. At Chrysler Corporation, the opportunity for fresh ideas and new talents never diminishes. There is a real challenge here . . . beckoning to young men and women with thorough educational backgrounds in mathematics and the sciences. Young people with imagination, daring and resourcefulness can find a richly rewarding career . . . working side by side with other engineers of Chrysler Corporation, helping to bring about the miracles of tomorrow.

CORPORATION PLYMOUTH • DODGE • DE SOTO • CHRYSLER

ask Gay Head

Gay Head

Q. I'd like to write to a girl who used to go to our school, but who just moved away. I have a lot of trouble writing letters, though, and I never know what to say. Can you give me some advice?

A. Try to imagine that you're "just talking" to the girl, and write about your daily doings and hers in any order that seems natural to you. Writing a friendly letter isn't like writing an English theme (with a critical eye and a blue pencil waiting to grade it), so don't worry about using any special style or the longest words you know. Your spelling and grammar should be correct, of course—but let your pet phrases and favorite slang expressions flow freely from your pen; she'll read them delightedly because they sound like *you!*

You might begin your letter with some questions about her doings of late—what her new school's like, how the settling-down-in-a-new-town process is coming along—anything that you're wondering about and would like to know. She'll not only be glad you're interested, but knowing what you'd like to hear about will make her *answer* easier to write!

Probably she's eager to hear about the goings-on in her old home town, so be generous with the news of happenings at school, among mutual friends, and around the community in general. The activities of day-before-yesterday may be "old stuff" to the people you see every day, but they won't be to her!

A good friendly letter is like your half of a good friendly conversation—spontaneous, relaxed, and simple. Keep this in mind and, with practice, you'll become a top-flight correspondent!

Q. Do you think it's all right to wear jeans with a clean blouse on a date, if you're just going for a ride?

A. Only if you're going on a *hayride!* A boy likes to feel that his date thinks enough of him to try to look her best when she's with him, even when a date is of the "most casual" variety. You don't have to be "dressed up" in order to make the most of your looks. On the other hand, do you know *any* girl who looks better in dungarees, even the cleanest jeans, than she does in a dress or skirt?

Besides, even on a casual ride you just *might* go somewhere where you'd be embarrassed to be seen in jeans. In a skirt, though, there'd be no possibility of this sort of discomfort.

When you've a date to go bicycling, or are bound for a hobo party or a picnic in the woods, your date should tell you ahead of time. Save your jeans for occasions like these, and try to welcome other dates as opportunities to "spruce up a bit." Otherwise, you may find your date appeal slipping in everything *but* the hayride category!

Fact Finders

By Katharine Lowery, Avonworth H.S., Ben Avon, Pa.

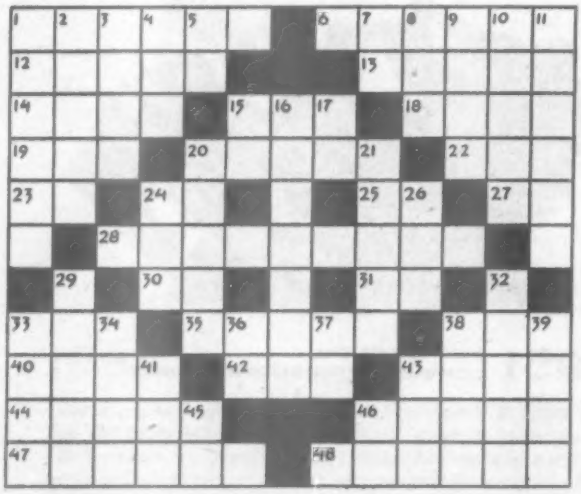
***Starred words refer to science and invention**

ACROSS

* 1. Invented first successful airplane.
* 6. Proposed atomic theory in 1803.
*12. Fleming and De Forest, early pioneers in ———.
13. Capture.
14. Paradise.
15. Health resort.
18. To shine.
19. Civil Aeronautics Administration (*abbr.*).
20. To be in an upright position.
*22. High explosive developed in 19th century.
*23. Chemical symbol for krypton.
24. Neuter pronoun.
*25. His theory is relativity (*initials*).
27. Ex officio (*abbr.*).
*28. Greek philosopher and scientist.
30. Half the width of an em.
31. Either (*abbr.*).
33. Spinning toy.
35. To pack into a bundle.
38. Trick, cheat.
*40. Waste matter of metal ore.
42. Exist.
43. Additional amount.
44. Collection of maps.
46. Danger.
*47. He isolated helium.
*48. Discovered much about heredity.

DOWN

1. Destroys, ruins.
* 2. Detecting device of great use in World War II.
3. Concept, notion.
4. Card game: ——— rummy.
5. Cry of surprise.
7. Like.
8. Limb of the body.
9. Lean, tip.
*10. Allotropic form of oxygen.
*11. Formulated laws of gravity.
15. Street (*abbr.*).
*16. Founded the science of bacteriology.
17. Indefinite article.
20. Restrict.
21. Tropical fruit.
24. Anger.
*26. Invented cotton gin.
*29. Developed voltaic cell.
*32. Discovered radium.
33. Former Russian ruler.
34. Part of the hand.
36. Egyptian sun god.
*37. Chemical symbol for selenium.
*38. Early automotive pioneer.
*39. Invented the telephone.
*41. Faraday, the first to make a liquid from a ———.
43. Male human beings.
*45. Chemical symbol for samarium.
*46. Professional engineer (*abbr.*).



Students are invited to submit original crossword puzzles for publication in *Scholastic Magazines*. Each puzzle should be built around one subject, which may be drawn from History, Art, Science, or any other field of knowledge. Maximum about 50 words, of which at least 10 must be related to the theme. For each puzzle published we will pay $10. Entries must include puzzle design, definitions, answers on separate sheets, design with answer filled in, and statement by student that the puzzle is original and his own work. Give name, address, school, and grade. Address Puzzle Editor, *World Week*, 331 Fourth Avenue, New York 10, N. Y. Answers in next week's issue.

SPORTS

New Faces for 1953

WHEN you open your newspaper these days, you don't have to turn to the comics for laughs. You can get your chuckles right on the sport page. Just read those tall tales from the baseball training camps. You know how they read:

"Bill Pfumff, veteran Sox twirler, reported to camp two ounces lighter than he was at the end of the 1952 season. He says he's in the best shape of his life and is a cinch to win 20 games."

The wise fan knows better. He knows that nine-tenths of the training camp stories are baloney—very tasty, it's true, but still baloney. Only a handful of the spring training heroes make good every year.

Nevertheless, the rookies make good "copy." So many of them show up so well that you can hardly blame their managers for raving about them. Yet nine out of ten will wilt under fire.

Figuring who that tenth man will be makes exciting guessing. So let's sift through the 1953 rookie crop and try to figure which of them will make it "big" this year.

American League Rookies

The Yankee dreamboat is Bill Skowron, a brawny ex-Purdue grid star who murdered the ball at Kansas City last season. He batted .341 while leading the American Association in homers (31) and runs batted in (134). Only 22 years old, he may be left at K.C. for another year's seasoning.

Bill's teammate of last season, first baseman Don Bollweg, is sure to get a close look. A .325 long-ball hitter, he was picked the most valuable player in the league.

Cleveland is high on pitcher Dave Hoskins, a right-hander who won 22 games for Dallas and had a remarkable 2.12 earned-run average. Prize hitting hope is outfielder Dave Pope, up from Indianapolis with a .352 mark that won the American Association batting title. Another outfielder, Mike Lutz, copped the Eastern League batting title with a .321 mark.

The Red Sox will try to get desperately needed pitching help from George Uhaze, an 18-game winner at Albany (N. Y.), while Washington is counting on catcher Les Peden, who hit 18 homers for Los Angeles, and first baseman Roy Hawes, who clouted 20 round-trippers for Chattanooga.

The Tigers gaze fondly upon outfielder Rufe Crawford who socked 27 homers for Scranton and was voted the most valuable player in the Eastern League. Frank Carswell hit .344 for Buffalo, leading the International League in both batting and home runs (30). Shortstop Harvey Kuenn hit .340 at Davenport and .325 in 19 games at Detroit.

The big hope of the Browns is Bill Hunter, the Fort Worth shortstop for whom the club forked over $90,000 and three players. A . 284 hitter, Bill is a terrific fielder. Other hopes are catcher Buck Baich, who banged .335 for Oklahoma City, and pitcher Bobo Holloman, a 16-game winner at Syracuse.

The White Sox only have eyes for pitcher Bob Keegan, who topped the International League with 20 victories and 27 complete games. Bill Wilson, returned from service, is a real sleeper. In 1950 he led the Southern Association in runs, homers (36), and runs batted in.

The Athletics are bringing up Tom Hamilton, whose .343 average won the South Atlantic batting crown, and two promising young pitchers. Marion Fricano won 17 at Ottawa and led the International League with a 2.26 earned-run average. John Mackinson won 16 games for a last-place team—Birmingham of the Southern loop.

National League Rookies

The apple of the Dodgers' eye is Junior Gilliam, a streak of light who was voted the most valuable player in the International League. He hit .301, scored 111 runs, and batted in 112 tallies. Right behind Junior is Don Zimmer, a flashy shortstop who hit .310 with 17 homers and 91 runs batted in at Mobile.

One of the aces in the Card deck is Jim Beavers, jumping into the majors all the way from Class D ball (Hazlehurst in the Georgia State loop), where he batted .363 with 21 homers and 108 runs batted in.

The Giants appear to have picked three plums in Daryl Spencer, the American Association all-star shortstop who hit .294 and slammed 27 homers; third baseman Rance Pless, who led the Southern Association with a fat .364; and catcher Ray Katt, a great defensive backstop who hit .304 at Minneapolis.

The Braves offer the sensational Jim Pendleton, International League all-star shortstop, plus: Jim Mainzer, a .326 hitting all-star shortstop from Wichita Falls; pitcher Don Liddle, who won 17 and lost only 4 with a 2.70 earned-run average at Milwaukee; and Chuck Tanner, who belted .345 at Atlanta.

Chief Red hopes are second baseman Johnny Temple who hit .306 for Tulsa; catcher Hobie Landrith, who batted .300 at Tulsa; and pitcher Barney Martin, who posted a 23-7 record at Columbia.

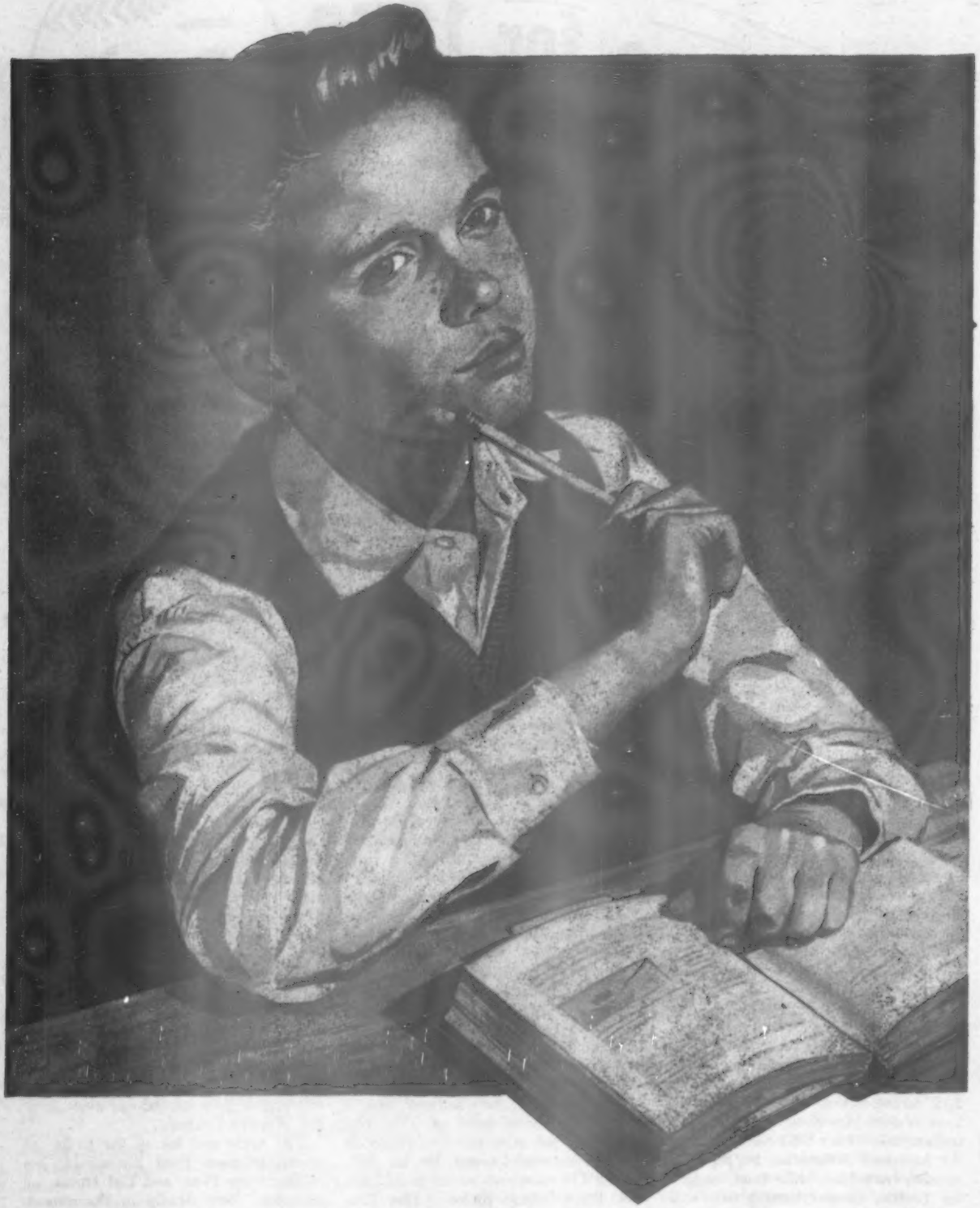
The Phillies are banking on Bob Greenwood, Western International League all-star pitcher with a 16-10 record including 23 complete games and an earned-run average of 2.45. Two other good young pitchers are Ron Mrozinski and John Sanford.

If the Pirates go anywhere this year, they'll get there because of outfielders Carlos Bernier, speed demon who hit .301 and stole 65 bases for Hollywood, and Frank Thomas, who hit .303, blasted 35 homers, and drove in 131 runs at New Orleans. Also watch out for Roy Face, who posted a 23-9 record and a 2.78 earned-run average in the Western League.

The pride and joy of the Cubs are young pitchers Fred Baczewski, Jim Willis, Vern Fear, and Cal Howe, all of whom were deadly in the minors.

HERMAN L. MASIN, *Sports Editor*

WANTED_



wide-awake day-dreamers

Where are these wide-awake day-dreamers, the Research Scientists of tomorrow? Right now they're in high school classrooms, preparing for their part in the Miracle of America.

Sinclair Research, in the endless search for new and better petroleum products, has an especial need for these young scientists when they are ready, offers them especially bright opportunities.

The famous Sinclair Plan is a typical example. Under this unique plan, Sinclair throws open its multi-million dollar research facilities to individual Americans, young or old, with worthy ideas for new or improved oil products or applications. The inventor must be protected at all times by a patent or patent application. Sinclair asks only the right to use the idea if the agreed work on the idea is completed and reported to the inventor. The inventor retains complete control and ownership.

Another example of Sinclair's continuing interest in the development of new scientists is the Sinclair Fellowship Program. Under this program, the Company sponsors promising graduate university students in such fields as chemistry, chemical engineering, geophysics, geology, petroleum engineering and catalysis.

At the present time, Sinclair Fellows are conducting these research projects at 13 colleges.

Why this heavy accent on youth?

Because Sinclair knows that Tomorrow's Scientist must come from Today's Youth—a youth who is dreaming today of a better tomorrow . . . *perhaps right in front of this page.*

SINCLAIR

A Great Name in Oil

SINCLAIR OIL CORPORATION
600 FIFTH AVENUE, NEW YORK 20, N. Y.

Don't let a BAD SKIN get you down!

Boys! Girls! Want to be popular? Of course, you do! Every normal human being wants to be liked and admired!

When teen-age skin problems threaten to spoil your good times, here's real help! Try this new way of cleansing your face with *medicated* Noxzema and water!

Teen-agers all over the country are thrilled with the way it helps heal externally-caused blemishes and helps skin look so much more attractive. See for yourself tonight:

1. Cleanse thoroughly—with Noxzema and water. Then just apply Noxzema to your face and neck; wring out a cloth in warm water and wash as if using soap. Notice how clean your skin looks! How much better it feels! Not dry or drawn!

2. At bedtime! Apply Noxzema over your whole face. You'll like its cool, pleasant tingle. Noxzema is not gummy! Not sticky! Doesn't show! Always pat a bit extra on any externally-caused blemishes to help heal them, fast! It's *medicated*. See if you don't notice a big improvement as you go on using this famous *greaseless, medicated* formula!

3. In the morning, wash again with *greaseless* Noxzema and water. Then apply Noxzema lightly over your whole face. It helps protect your skin all day—it's greaseless—no shiny nose.

Generous trial offer! Get regular 40¢ size for only 29¢ plus tax—at any drug or cosmetic counter. After you prove for yourself how Noxzema helps heal problem skin and helps *keep* your skin looking smooth and attractive, you'll always want to buy the big thrifty 10 oz. jar—only 89¢ plus tax.

HOW WOULD YOU SOLVE IT?

Heading for a Crash

The Stamp Club meeting was about to start, when Nick Sawyer came in.

"Hi, fellahs," he grinned. "Guess what? Sue Carter's throwing a party tonight! I suggest we skip the meeting and investigate the goings-on over there. The Carters always have the best 'eats' in town, and lots of the gang'll be there. How about it?"

"But we weren't invited," objected Jim Blakely.

"Aw, what's the difference?" insisted Nick. "*I'm* not going to chicken out!"

• • •

1. If you were a member of the club, what would you have done? Gone along with Nick and "crashed" Sue's party? Told him he could go if he wanted to, but that you wouldn't? Tried to persuade him not to go? What arguments would you try?

2. Is there anything wrong with "crashing" a party? Does it depend on the number of "crashers"? Whether there are plenty of refreshments? Whether space is limited? Might Sue's plans be upset by uninvited guests?

3. What can a host or hostess do about unwelcome party "crashers"? Close the door in their faces? Ask a parent to "make them leave"? Call the police? Explain that there aren't enough refreshments for "extra" guests? Try to act pleased and invite them to come in? Ask them to come back another time? How would you feel if someone "crashed" a party you were giving? What would you do?

4. Why do people "crash" parties? Because they want to "follow the crowd"? Because they're bored and have nothing else to do? Because they're annoyed that they haven't been invited? Because they think they'll be welcome, or at least that nobody will object? Because they think the other guests will be amused? Because they don't care about anybody else's feelings? Because they have no pride in their own behavior—or in themselves?

TO YOUR GOOD HEALTH

Fish gives you the same proteins for healthy growth that meat does. Eat it often. Since fish doesn't "stick to the ribs" like meat, top off a fish meal with pudding, pie, or custard dessert.

CHIQUITA TO THE RESCUE
THIS WALK HOME IS WORSE EVERY DAY. I'M BEAT.
BOY, SO'M I. BY 3:00 I FEEL LIKE I'VE BEEN DIGGING A DITCH WITH A TEASPOON.
MY MARKS ARE SCRAPING BOTTOM.
FLUNK
YOU SHOULDA HEARD THE COACH BLOW UP TODAY. I REALLY THOUGHT I WAS FINISHED.
THINGS ARE LOOKING WAY DOWN. WHATTA WE DO NOW?
IT'S SIMPLE. TAKE A TIP FROM ME. HERE, DIG IN FOR SOME QUICK ENERGY.
WOW! CHIQUITA, YOUR BANANAS ARE POWER-PACKED. C'MON, BILL, I'LL RACE YOU HOME.
Teeners love fully ripe, energy-packed bananas! For a FREE copy of my banana song fill out and mail the coupon below.
United Fruit Company, Dept. SM
Pier 3, North River, New York 6, N. Y.
Please send me FREE Chiquita Banana's song.
NAME
ADDRESS
CITY
STATE

What Are 'Approvals'?

Scholastic Magazines accept stamp advertisements only from reliable and trustworthy stamp dealers. Our readers are advised to read an advertisement carefully before sending money for stamps. If the advertisement mentions the word "approvals," the stamp dealer will send you in addition to any free stamps, or stamps you pay for in advance, a selection of other stamps known as "approvals." Each of these "approval" stamps has a price clearly marked. If you keep any of the "approval" stamps you must pay for them and return the ones you do not wish to buy. When writing to stamp advertisers be sure to write your name and address on your letter and on the upper left hand corner of the envelope. If you do not intend to buy any of the "approval" stamps return them promptly, being careful to write your name and address in the upper left-hand corner of the envelope in which you return the stamps. Scholastic Magazines will do all in their power to protect their readers from unfair practices. Any reader who considers that he has been deceived as a result of his response to an advertisement in Scholastic Magazines is urged to appeal to the Executive Editor, Scholastic Magazines, 351 Fourth Ave., New York 10, N. Y.

300 STAMPS FOR ONLY 10¢
THIS MAMMOTH VALUE INCLUDES STAMPS WORTH UP TO 25¢! ALSO APPROVALS. WRITE TODAY!
MYSTIC STAMP CO. Camden 15, New York

327 DIFFERENT STAMPS 25¢
Including Early Canada, Newfoundland, British Colonies, Vatican, Red Russia, Hitler Heads, Indian States, Animals, Airmails, French Colonies, rarities, unusuals. Every stamp different. Rare bargain only 25¢ with our Bargain Approvals. Money back guarantee.
NIAGARA STAMP CO., Niagara-On-The-Lake 422, Can.

U. S. Classics—50 Yr. Old Collection
15 selected old-timers. Each 50 or more years old—Most of 'em missing in even the biggest collections! Get all 15 of these unusual classics for less than 1c each. All yours for just 10c! With your request for approvals.
JARO STAMP CO., Box 246-D, Church St. Annex, N. Y. 8

CANADIAN COLLECTION FREE!
Includes early Victorian Issues — Jubilee Issues — High Values — Commemoratives — Special Issues — Newfoundland and many Pictorials, etc., etc., together with large Philatelic Magazine—all FREE with approvals. Send 5¢ for postage. Empire Stamp Co., Dept. SS, Toronto, Can.

WOW! 203 All Different GERMANY 15c
Zeppelins, Semi-postals Airmails, High Values, etc., to new customers.
Jamestown Stamp Co., Dept. 510, Jamestown, N. Y.

FREE! "THE STAMP FINDER" Tells at a glance the country to which any stamp belongs. 32 pages illustrated. Includes valuable "Stamp Collector's Dictionary." Stamp Treasures and World's Ten Rarest Stamps. Also Approvals.
GARCELON STAMP CO., Box 1194, Calais, Maine

U. S. ARMY & NAVY HEROES
A collection featuring U. S. Army & Navy Heroes on stamps from War of 1812, Civil & Revolutionary and others. A Pictorial History. 10c with bargain U. S. approvals.
LOCUST STAMP CO., Box 205-Q, OSSINING, N. Y.

107 DIFFERENT 3c
Stamps from Cochin-Oceanic, Cameroun, Malta, Cyprus, etc., to Approval Buyers.
DIXIE STAMP CO., Dept. 44, Milwaukee 1, Wis.

FREE. $22.50 CATALOGUE VALUE
Raymax Plan offers free colorful collection cataloguing $22.50, plus Scott's international Stamp Album and many other big premiums, with approvals. Write today. 3c postage please.
RAYMAX, 70 AA Nassau St., New York 7, N. Y.

TWO BIG PICTORIAL SETS 5c
UNUSED STAMPS FROM THE VATICAN AND SAN MARINO TO THOSE REQUESTING OUR FINE APPROVALS
SILAS STAMP SERVICE
Box 58-S Tribore Sta., New York 35, N. Y.

GIVEN! Foreign Coin, Banknote and large illustrated coin list GIVEN to approval service applicants for 3c postage. BARGAINS: 5 Indianhead cents, 10c; Wooden nickel, 10c; Chinese Dollar, 35c.
FATHAM EDIN 92 LONDON GREENWICH

STAMPS

Canada's Wildlife Set

On April 1 Canada will issue three animal stamps for its national wildlife week, April 5-11. Canada has started a drive to stir up interest in the importance of protecting wildlife resources. Government officials report that Canada's wildlife is "being depleted at an alarming rate."

The three stamps show commonly known wild animals of Canada. The 2¢ blue pictures a polar bear, the 3¢ brown a moose, the 4¢ black a bighorn sheep. Stamps showing other wild animals will be issued every year in the future.

Canada recently issued an Indian totem pole stamp in black. The $1 stamp shows a totem pole and a Pacific Coast Indian house against a background of mountains. Totem poles were used by many North American Indians to record their tribes' history and customs. With great skill the Indians carved animals and gods on the poles.

STAMPING GROUNDS: On April 24 the United Nations will issue its first new stamp for 1953. It will be a "refugee" stamp—to serve as a reminder that many persons today are homeless and in great need. During the rest of 1953 the U. N. also will issue stamps paying tribute to United Nations Day, Human Rights Day, the Universal Postal Union, and a U. N. specialized agency.

Next week Japan will issue a stamp commemorating the 75th year since the first electric lights were used there. The stamp shows an old-fashioned arc lamp, the kind used before Edison invented the incandescent lamp in 1879.

The polar bear stamp

Courtesy of Canadian Information Service
The sheep and moose stamps

✓✓✓✓ Tops, don't miss. ✓✓✓Good. ✓✓Fair. ✓Save your money.

✓✓THE STARS ARE SINGING. (Paramount. Produced by Irving Asher. Directed by Norman Taurog.)

Rosemary Clooney fans will be delighted by the way their favorite singer handles herself in her first movie assignment. She's attractive in a relaxed, humorous way—bouncy but not boisterous. However, her fans are less likely to be enthusiastic about the improbable cornball that serves to introduce her. It demands that she take under her wing young Anna Maria Alberghetti, an illegal entry from behind the Iron Curtain, and get her on a television show to convince Americans that she should be allowed to stay over here.

Since Lauritz Melchior is also involved in this fantasy, there are frequent interruptions for vocal display—everything from *Vesti la Giubba* to *Come On-a My House* is dusted off by one or another of this ill-assorted trio.

Like a vaudeville, *The Stars Are Singing* tries to offer something for everybody, but it has hardly enough for anyone.

MOVIE CHECK LIST

The Movie Check List is printed each week as your movie-going guide. Here's how our check system works: **✓✓✓✓Tops, don't miss**—cream-of-the-crop films you're likely to remember for two or three years. **✓✓✓Good**—all-around, good entertainment; just short of being top-notch. **✓✓Fair**—interesting in part to some moviegoers. **✓Save your money**—dull, untrue, or even harmful.

Drama: ✓✓✓✓Breaking the Sound Barrier. ✓✓✓✓Above and Beyond. ✓✓✓✓My Cousin Rachel. ✓✓✓Member of the Wedding. ✓✓✓Wherever She Goes. ✓✓✓Face to Face. ✓✓Eight Iron Men. ✓✓Pony Soldier. ✓Angel Face. ✓Desperate Search. ✓Thief of Venice. ✓Thunder in the East. ✓Taxi.

Comedy: ✓✓✓✓The Importance of Being Earnest. ✓✓✓✓My Pal Gus. ✓✓✓✓The Promoter. ✓✓✓Androcles and the Lion. ✓✓✓The Stooge. ✓✓Never Wave at a WAC. ✓✓No Time for Flowers. ✓Abbott & Costello Meet Captain Kidd. ✓Babe in Bagdad. ✓The Clown.

Musical: ✓✓✓✓Hans Christian Andersen. ✓✓✓I Love Melvin. ✓✓✓Stars and Stripes Forever. ✓✓✓Road to Bali. ✓✓The Jazz Singer. ✓✓Million Dollar Mermaid. ✓✓All Ashore. ✓✓Meet Me at the Fair. ✓April in Paris. ✓Stop, You're Killing Me.

Animated Cartoon: ✓✓✓Peter Pan.

Sentimental

Seen in the "Lost and Found" column of the San Diego *Union Tribune:*

"Tan leather wallet—containing pictures, personal papers and $350 currency. Finder may keep the pictures, the personal papers and the wallet, but I have a sentimental attachment to the money."

Sales Trails

Proof

Jones: "Do you believe in free speech?"

Smith: "Certainly!"

Jones: "Splendid! May I use your telephone?"

Setting the Pace

First homemaker: "My husband has a one-track mind."

Second homemaker: "You should complain. My husband's is like a helicopter—hopping all over the place."

Polaroo

Answer

The teacher was explaining to the class that a number of sheep is called a *flock* and a small number of quail is called a *bevy.*

"Now," she said, "what is a number of camels called?"

A nine-year-old ad reader had a quick answer: "A carton."

The Kablegram

Some Pun!

Joe: "My brother works on Saturdays and Sundays as a trimmer in a candle factory."

Moe: "Doesn't he work on Mondays, Tuesdays, Wednesdays, Thursdays, and Fridays?"

Joe: "No. He just works on wick ends."

Lone Star Scanner

With Meat Balls

Bo: "I saved up my money and bought a farm ten miles long and half an inch wide."

Joe: "What are you going to raise on it?"

Bo: "I planted spaghetti on it."

Cued

Fresh Retort

The food at the mess hall wasn't exactly Waldorf-Astoria style, but the quality of the bread drew the most complaints from the men. Finally, a squad corporal went to the mess sergeant to present the mass protest.

"Nonsense," snapped the sarge. "Soldiers shouldn't fuss over such trivialities. Why, if Napoleon had had that bread when he was crossing the Alps, he'd have eaten it with delight."

"Yeah, but it was fresh then," the corporal replied.

Trails

Whew!

A man was traveling through Alabama and in talking to a native asked if it were true that hot weather was good for a cotton crop.

"Well," drawled the old farmer, "somebody said so at one time and it was too hot for anybody to deny it, and that's how the foolish idea got started."

The Kablegram

Practice Session

One evening a young matron, returning from a first-aid class, came upon a man sprawled face down on a darkened side street. "Ah!" thought the woman, "now I can minister to this poor unfortunate."

Parking her car nearby, she rushed over and began artificial respiration.

Presently the man stirred, looked up, and speaking with difficulty said: "I'm holding a lantern for a guy working down in this manhole. I'm not sure what you're up to, lady, but I wish you'd let me get on with my work."

The Woman

Fatherly Pride

The pastor had been invited out for dinner. After he had consumed a good deal of the chicken which the hostess had prepared, he leaned back in his chair and, gazing out the window, noticed a fine rooster.

"My what a fine proud rooster you have!" said the reverend.

"He should be proud," replied the host. "His son just entered the ministry."

Roger Gale

Answers to last week's Crossword Puzzle

ACROSS: 1-Poland; 7-Romania; 8-soles; 9-ovens; 10-Aus(tria); 11-Fi(nland); 12-Alb(ania); 13-in; 14-Soviet; 17-ago; 19-L. S.; 20-red; 22-Sea; 24-soam; 25-A. B.; 27-apass; 28-Hungary; 30-alders.

DOWN: 1-Pole; 2-omen; 3-lass; 4-an; 5-Ni; 6-Danube; 7-roving; 8-Sofia; 10-(St)ali(n); 12-(Sl)avs; 15-old; 16-teams; 18-or; 21-El(be); 22-soars; 23-easy; 24-spar; 25-aha; 26-Bul(garia); 27-age; 29-N. D.

Study ART in MIAMI

Commercial, Fine Arts, Interior Design, Fashion Illustration, Fashion and Costume Design, Art in Advertising, Portrait, Still Life, Landscape, Rooms available reasonable rates. Inquire regarding time payment plan.

TERRY ART INSTITUTE

"America's Most Progressive Art Institution."

2323 S.W. 27th Avenue Miami, Fla.

Blemishes

Cuticura helps clear them up fast

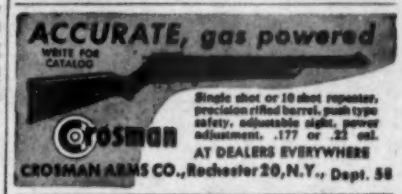
You'll be amazed how fast blackheads and externally caused pimples yield when you lather-massage with Cuticura Soap twice daily—apply Cuticura Ointment nightly—and use new "invisible" Cuticura Liquid during the day. Buy today sure.

SENIORS Sell your classmates America's Most Beautiful and complete line of Modern GRADUATION NAME CARDS and earn sensational commission. Free Memory Book with cash order. Write today for free sample kit.

PRINTCRAFT, Dept. S
1809 Maple St., Scranton 5, Pa.

CHICAGO ACADEMY of FINE ARTS Founded 1902

DIRECT PROJECT TRAINING
Commercial Art • Drawing
Fashion-Magazine Illustration
Interior Decoration • Cartooning
Dress Design • Painting
ALL PROFESSIONAL FACULTY
Write for free catalog Z
720 Rush St. • Chicago 11, Ill.



Single shot or 10 shot repeater, precision rifled barrel, push type safety, adjustable sight, power adjustment. .177 or .22 cal.

AT DEALERS EVERYWHERE

CROSMAN ARMS CO., Rochester 20, N.Y., Dept. 58

Buy U. S. Savings Stamps

FREE Book for Fishermen

completely NEW

100 pages of fishing tips — how to bait, fly, spin cast — fish pictures — records — tackle. *Write now.* FREE.

SOUTH BEND BAIT CO.
877 High, South Bend, Ind.

FREE-CAST® REEL with NEW SPEED CONTROL. No thumbing or backlashes. Adjusts for lure weight and wind. $11.

SOUTH BEND

"Situation well in hand"

The offer of Coca-Cola fits so many occasions
. . . greeting a friend, hospitality in the home,
relaxing with a fellow worker.
Whatever the circumstances,
the refreshing quality and taste delights
of ice-cold Coke please everyone.
Make *your* orders of the day . . . Coca-Cola.

COPYRIGHT 1953, THE COCA-COLA COMPANY

"COKE" IS A REGISTERED TRADE-MARK.